# THE IMPACT OF AN ENVIRONMENTAL EDUCATION PROGRAM ON THIRD GRADERS' KNOWLEDGE, ATTITUDE AND BEHAVIORAL INTENTIONS

A Thesis

by

CARIN ELIZABETH VADALA

Submitted to the Office of Graduate Studies of
Texas A&M University
in partial fulfillment of the requirements for the degree of

MASTER OF SCIENCE

May 2004

Major Subject: Recreation, Park & Tourism Sciences

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# ABSTRACT

The Impact of an Environmental Education Program on Third Graders' Knowledge Attitude and Behavioral Intentions. (May 2004)

Carin Elizabeth Vadala, B.S., Texas A&M University

Chair if Advisory Committee: Dr. Peter A. Witt

The purpose of this study was to measure whether an after-school environmental education program based on modified Project Wild materials, positively impacted third graders environmental knowledge, attitudes and behavioral intentions. Eight lesson plans were developed, piloted and re-designed over a one year period and then delivered to third graders for a total of eight weeks in a fall semester. The lessons included units on water, air, land, recycling, insects, fish, amphibians, reptiles, birds and mammals. A pre-post test retrospective questionnaire was developed to determine changes in the participant's knowledge, attitudes and behavioral intentions as a result of participating in the program. Results indicate positive shifts in knowledge and changes in environmental attitudes and behavioral intentions. Recommendations were also made for future studies.

## DEDICATION

This is for all the love and support my family, especially my parents, has given me. I never could have accomplished this without your guidance. I love you all.

## ACKNOWLEDGEMENTS

I would like to thank Dr. Witt for his constant guidance, support and patience. In the two short years I have been a part of the department, you have taught me more than you'll ever know. You were constantly offering me new ideas and helped guide this research to what it has become. Your legacy will live on through me and I am so proud to have had you as an advisor.

Thanks to my other two committee members Dr. Shafer and Dr. Bunting. Your advice on lesson strategies, statistics and also with my survey helped me to make this project better. Thanks also to Kathy Haras for teaching me environmental games and also lending me debris for the minefield game.

To Jana Wood-Cope, I would not even have had a research project if you had not allowed me to volunteer in Kid's Klub. Thank you for believing in me and trusting me to produce a quality program that was consistent. I had a wonderful time working with your site supervisors and enjoyed every moment I had with the students. It is my hope that you will continue this program or something similar for the students because I really think they enjoyed every moment of it.

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# CHAPTER I

## INTRODUCTION

As humans, we were born citizens of the world, countries, states and cities. One component of citizenship is being responsible for the environment. According to Mabogunje (2002), escalating environmental degradation includes deforestation, desertification, biodiversity loss, erosion, urban pollution, water pollution and climate change. Along with exponential population growth, these problems are especially significant in developing countries. For example, many scientists agree that at the current rate of deforestation, five to ten percent of species in tropical rainforests will become extinct each decade. This averages out to approximately one hundred species a day; which is significant since it is estimated that tropical rainforests contain more than fifty percent of the Earth's species (Mabogunje, 2002). Educating individuals about environmental issues should enable people to develop the knowledge, attitudes, and skills that increase the chances that they will be good environmental citizens.

Environmental education programs are one means for helping create good environmental citizens. Environmental education programs attempt to increase the public's knowledge about environmental issues, change attitudes about the necessity of preserving the environment, and provide people with the skills to do so. Programs designed to educate children are thought to be particularly effective by reaching them

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This thesis follows the style and format of *The Journal of Environmental Education.*

during the formative stage, thus increasing the chances that they will grow up to be environmentally sensitive adults.

Project Wild is an example of a carefully developed, widely used environmental curriculum. This program was specifically designed to catch student's environmental interest at an early age. It provides materials that can be used throughout the curriculum, including areas such as math, science and English. The program is offered across the United States for students in grades K-12.

The recent interest and growth in after-school programs provide additional settings in which programs like Project Wild can be presented. Because many children attend after-school programs on a regular basis, these settings provide a good opportunity to offer environmental education programs. However, to date little study has taken place of the applicability of environmental education materials in these settings.

**Problem Statement**

The purpose of this study was to measure whether an environmental education program, the Discovery Club, based on Project Wild materials, positively impacts third graders' environmental knowledge, attitudes and behavioral intentions.

**Rationale for the Study**

An effective environmental education program should provide a knowledge base that is appropriate for the target age group, and should require children's active participation (Basile, 2000). If knowledge can be transferred to a real or meaningful

situation in a person's life, participants should be able to, and are more likely to, make important decisions regarding the environment and how to protect it (2000).

Fishbein and Ajzen's Theory of Reasoned Action provides a good framework for understanding the development of knowledge, changes in attitudes, and ultimately changes in behavior. According to the theory, behavior is a function of the individual's attitude toward the behavior and subjective norms or knowledge (Eagley & Chaiken, 1993). Many studies focus on behavioral intentions instead of behavior; making the assumption that intention to behave will lead to the behavior (Becker & Gibson, 1998; Bright & Manfredo, 1996; Orams, 1997 & Ray, 1991). It is difficult to measure whether the behavior happened or not. Measuring behavioral intentions means that the researcher does not have to wait until the behavior is performed to asses the potential for a given program or intervention to impact behavior (Figure 1).

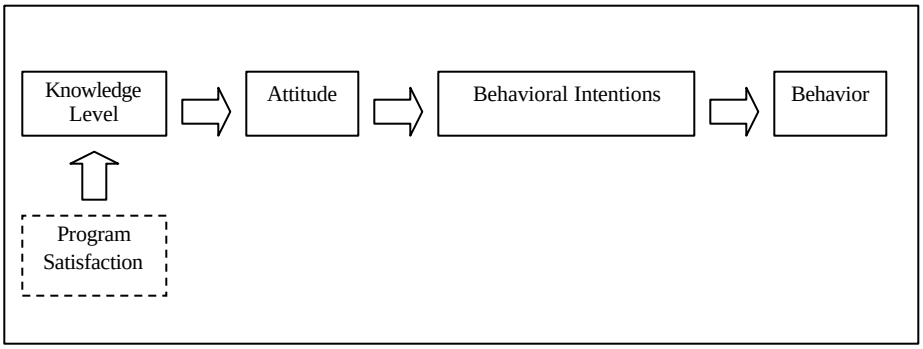



Figure 1: Theory of Reasoned Action (Ajzen & Fishbein, 1980)

A possible addition to the Theory of Reasoned Action is to include program satisfaction, since the impact of an environmental education program may also be a

function of students' satisfaction with the quality of the program. Students who are more satisfied are more likely to pay attention and increase their environmental knowledge. Students who are less satisfied with the program will not increase knowledge as much compared to students who are more satisfied.

The current project will lead to the development of nine lesson plans for teaching environmental education to third graders in an after-school setting. Third graders will benefit from the study through participating in a high quality environmental education program. Hopefully, society will benefit through the increased environmental knowledge, attitudes, and behavioral intentions of its future citizens.

**Objectives**

The objectives of the study were to determine if students participating in an after-school environmental education program:

(1) increase their knowledge of air, water, land, and recycling, including but not limited to, the ozone, clouds, rain, fresh & salt water, desert, mountainous terrain and recycling and reusing materials;

(2) increase their ability to describe the distinguishing characteristics of insects, fish, amphibians, birds and mammals;

(3) increase their knowledge about recycling and conservation practices and promoting conservation of land and wildlife; and

(4) increase their knowledge about local flora and fauna in the local community where the program is presented.

In addition, the study seeks to determine if:

(5) increases in knowledge are related to changes in attitudes and behavioral intentions about the environment.

**Hypotheses**

1. Students who are satisfied with the program will show higher levels of knowledge about the program.
2. Students who participate in the program will increase their knowledge in the subject areas of water, air, land, recycling, fish, insects, amphibians, reptiles, birds and mammals compared to students who do not participate in the program.
3. Students who participate in the program will show significant changes in their attitudes and behavioral intentions toward the environment.
4. Students who participate in the program will show significant changes in post-test attitude and behavioral intentions toward the environment compared to students who do not participate in the program.
5. Students who have more post-program knowledge about the program will have significant changes in post-program attitudes and behavioral intentions.

**Delimitations/ Limitations**

The main limitation of this study was its small sample size. The study consisted of approximately thirty third-graders who attended two of the seven Kid's Klub sites, an after-school program offered by the City of College of Station Parks and Recreation Department and the College Station Independent School District. Researchers delimited the sample to focus only on third graders who attended Kid's Klub. There were between

30 and 40 third graders attending the after-school program at the two sites. The final sample size was determined by two factors: (a) if parents signed the consent form for their child to participate in the Discovery Club program, and (b) if the students chose to attend. Few options existed for increasing the sample size, since certain elements of a parent and student's decisions are beyond the researcher's control. The resulting small sample made it difficult to obtain statistically significant results and the results cannot be generalized across all third graders in the district.

A second limitation was dosage, or the amount of the program that children actually experienced even when they had permission to participate and were signed up for the program. Past experience with presenting environmental programs as part of the Kids Klub suggested that only a few children would attend every program session. They may be absent from school or choose not to attend on a given program day. These factors create problems by limiting the amount of the program to which children were exposed and possibly collecting data at the end of the program if students are absent on that day.

A delimitation of the study was the data collection process. There were eight different lesson plans with one being presented during each week of the program. Since a retrospective pre-post design was used to collect the data, pretest data was only collected at the end of the program. However, at the end of the program students may not have been able to remember their attitudes or behavior when they started the program. In addition, at the end of the program, students might not remember

information from the early program sessions or students may have dropped out and not be available to complete the testing.

The program was conducted by one leader to minimize variations in teaching style. However, any impacts in the program may have been a function of characteristics and abilities of that leader, e.g., the leader's ability to get the students involved and excited about the program.

**Definitions**

The *Discovery Club* was offered as part of the Kid's Klub after-school program. The Discovery Club program consisted of eight one-hour lessons, with one lesson presented each week for eight consecutive weeks. Kids Klub is "a recreational and enrichment based after-school program for elementary and intermediate school age children" offered by the College Station Independent School District and the College Station Parks and Recreation Department. The program operates at the five elementary schools and two intermediate schools.

*Environmental education* was defined as "a lifelong learning process aimed at developing an environmentally literate citizenry that has the knowledge, skills, and commitment to make responsible decisions that impact environmental quality (National Environmental Education Advisory Council, 1996, p. i.).

*Experiential education* "is a philosophy and methodology in which educators purposefully engage with learners in direct experience and focused reflection in order to increase knowledge, develop skills, and clarify values."(Association for Experiential Education, 2002, ¶2).

**Organization of the Thesis**

This introduction will be followed by a review of literature about both environmental education and after-school programs and how participation in such programs may impact knowledge, attitudes and behaviors (Chapter two). Chapter three will outline the study setting, program that was presented, selection of the subjects, questionnaire development, data collection procedures, operational definitions of the variables and statistical approaches to analyzing the data. Chapter four gives results of the statistical analyses. Chapter five discusses the study's results and provides recommendations for future studies.

# CHAPTER II

# REVIEW OF LITERATURE

The review of literature is divided into seven sections. It begins with a discussion of environmental education and its history and current status, followed by delineation of types of approaches that have been used to offer environmental education programs, and studies that have been done to determine environmental education program outcomes. The development of after-school programs, the movement to make after-school experiences more than "fun and games," the theory of reasoned action, and the development of the rationale for the retrospective pre-post testing procedure will also be discussed.

## Environmental Education

Hanna (1995) hypothesized that "providing children and young adults with direct experiences in outdoor-adventure activities and an early introduction to ecological concepts" predisposes them to gain knowledge, which in turn may lead to change in attitude and behavioral intentions (p. 29). "Experiential education programs can have a positive impact on students' psychological, social and intellectual development," and have been shown to increase student's character qualities such as self-esteem, reasoning and responsibility (Conrad & Hedin, 1981, p. 9). Many students learn better by doing. Activities that are created to have students learn by participating have been shown to work better than when they are passive recipients of programs or information (Basile, 2000, Conrad & Hedin, 1981, Horton, 1999, Matthews, Flage & Matthews, 1997, Orr, 1999).

If learning by doing and participating in interesting environmental education programs creates transfer, then it makes sense to attempt an environmental program in an after-school setting.

**History of Environmental Education**

In 1977, the United Nations Education, Scientific, and Cultural Organization (UNESCO) and U.N Environment Program (UNEP) held the world's first environmental issues conference in Tbsilisi, Georgia (USSR). According to the Tbilisi Declaration (1977), environmental education plays an important role in "the preservation and improvement of the world's environment, as well as in the sound and balanced development of the world's communities" (p. 3). Guidelines for environmental education at all levels for both formal and non-formal education were written in the Tbilisi Declaration (1977).

By 1980 very few states had developed environmental education legislation (Ramsey, Hungerfod & Volk, 1992). Only Arizona, Florida, Iowa, Pennsylvania, and Wisconsin worked to implement programs in their school systems. Childress conducted the last study of environmental education curricula in 1976. Childress (1976) concluded that environmental education had little sense of direction and no one took charge to develop and test useful ways to implement programs.

By the 1990's a world movement promoting the need for environmental education had begun. On November 16, 1990 the President of the United States signed into law the National Environmental Education Act (P.L. 101-619; Environmental Education Act, 1990). Under the U.S. Environmental Protection Agency, the act was the

first attempt at mandating environmental education as a way to help protect the environment.

In 1992, Ramsey, Hungerford and Volk (1992) listed the environmental education resources available to supplement school curricula. They suggested Project Learning Tree, Project Wild-Elementary, and Naturescope. These are different resources used to infuse environmental education into already existing curricula (1992).

Leeming, Dwyer, Porter and Cobern (1993) conducted a thorough review of outcome research in environmental education. They analyzed thirty-four studies and divided each study into one of two categories, in-class and out-of-class programs. The researchers found that all of the studies conducted between grades kindergarten and 4 occurred in the classroom, and that most of the in-class studies involved programs that mainly consisted of lectures. The out-of-class programs were deceiving in that most of the studies occurred in school where classes participated in activities outside or went on field trips. Besides adult programs, both the in-class and out-of-class studies were still a school setting.

This review suggests that there is a gap in environmental education research. There have not been many analyses of environmental education programs that are not associated with school. The easiest place to find a large sample of kids is in the classroom. The teacher is usually the one administering the program and the outcome questionnaires, which allows for error and bias because each teacher will teach the program slightly differently.

**Current Status of Environmental Education**

The National Environmental Education Advisory Council (1996) wrote a Report Assessing Environmental Education in the United States and the implementation of the National Environmental Education Act of 1990. In the report the status of formal vs. non-formal environmental education is examined. Formal education occurs from grades K-12, and occasionally in post secondary settings. Non-formal education occurs in places such as zoos, aquariums, and community centers or even through the media. While universities and colleges are leading the field in research and evaluation (1996), much of the research has focused on adult or young adult participation in environmental education and not school-aged childrens' participation (Gunderson, Barns, Hendricks & McAvoy, 2000).

Nongovernmental organizations play a large role in environmental education. Organizations such as World Wildlife Fund, National Audubon Society, North American Association for Environmental Education and the National Science Teachers Association often help to develop curriculum and training with programs at a variety of sites.

Although progress has been made over the years, environmental education still faces many challenges (National Environmental Education Advisory Council, 1996). Federal and state agencies, nongovernmental organizations, educational institutions and many others have created effective education programs, all working toward the same goal in different ways (Wicks, McCrea & Disinger, 2001). According to the National Environmental Education Advisory Council Report (1996), there are eight issues or challenges facing environmental education:

> (1) environmental education is not a priority across the country, (2) state, local and tribal efforts need greater resources and support, (3) resources are limited and no one sector can support the entire field, (4) professional development for teachers and non-formal educators needs greater support, (5) environmental education is not well integrated into education reform and improvement, (6) important audiences are not being reached, (7) evaluation, quality, assurance, and access to materials and information on programs is limited, and (8) more well trained environmental professionals are needed (p. 14).

The purpose of the Environmental Education Advisory Council Report (1996) was to assess current environmental education in the United States. Based on this assessment, the council recommended eight actions to congress:

> (1) make environmental education a priority across the country and enhance EPA's leadership roles, (2) increase and sustain support for state, local and tribal Efforts, (3) leverage public and private resources and strengthen long-term cross-sector partnerships, (4) enhance and increase support for professional development for teachers and non-formal educators, (5) integrate environmental education into education reform and improvement, (6) target new audiences, (7) increase support for evaluation, complete guidelines, and improve access to materials and information on programs, and (8) encourage and support environmental careers (p. 25).

The world changes daily with advances in technology and knowledge. In previous generations emphasis was placed on development and expansion and there was little need to learn how to protect the environment. However, even in the past few decades, steps have been taken to implement meaningful effective environmental education programs. These programs must be "active" and convey the importance of protecting the environment in order to have effects on our quality of life (Basile, 2000; Bunting & Towley, 1999; Conrad & Hedin, 1981; Hudson, 2001 & Orr, 1999,). One way of transmitting up to date information is the Internet. There are several programs offered on the web (Moore & Huber, 2001). Programs such as Global Learning and Observation (www.globe.gov); Global Rivers Environmental Education Network (www.igc.apc.org); and Students as Scientists: Pollution Prevention Through Education

(http://www.uncwil.edu/student_scientists/) all support experiential outdoor learning (Moore & Huber, 2001). These programs provide resources for K-12 science teachers and help them to integrate environmental education into the classroom. Rickson (2001) conducted an extensive review of environmental education research. This review discussed trends in environmental education research conducted in a school setting. Rickson reviewed 110 articles that were published from1993-1999. It shows the growth in programs that has occurred over the past six years.

Excluded from the review were "publications that have no empirical component; studies of environmental education not undertaken in or through schools; studies of teachers, or adult learners or university students; research published prior to 1993 or in languages other than English; unpublished work such as doctoral and masters theses" (p. 211). The researchers decided against stating a single definition of environmental education so as to include articles containing any mention of environmental education.

Although there are similar trends occurring in environmental education research, there is not a widely accepted format for conducting the research. However, Rickson (2001) noted six trends in research that had been conducted. Three of the six, students' environmental knowledge, attitudes and behaviors, and learning outcomes were more established in research. The other three, students' perceptions of nature, experiences of learning, and students' ability to influence adults were considered as emerging research areas.

According to Rickson (2001), there are "three main weaknesses in the current evidence base: (i) its methodological uniformity; (ii) its substantive imbalances; and (iii)

its fragmentation" (p. 306). Considering learners and learning, the field is comprised of quantitative research with passive subjects instead of qualitative research with active learners. Imbalances occur in studies that focus on learning outcomes as opposed to learning processes and "about students' environmental ideas and perceptions, than there is about their educational experiences and preferences" (p. 216). Fragmentation has occurred because researchers focus on creating new methodological processes instead of making connections between previous research studies and identifying research gaps.

**Approaches to Environmental Education**

The Western Region Environmental Education Council (WREEC) was created in 1970 in order to create partnerships between education and natural resource professionals (Project Wild Web page, 2000). Project Learning Tree was the first attempt at creating education programs "using the forest as a window on the world to increase students' understanding of our complex environment and related issues" (2000).

In 1980 the WREEC partnered with the Western Association of Fish and Wildlife Agencies to develop Project Wild. Project Wild was developed, tested and revised for three years and finally released in 1983. Project and Aquatic Wild was further revised between 1983 and 1991. Project Wild consists of lessons about conservation and resources that live on land, while Aquatic Wild tackles the same issues for aquatic habitats. By 1991, all 50 states, and six national and five international countries sponsored Project Wild and Project Wet had begun. Project Wet deals with issues specifically pertaining to water. The Project Wild activity guidebooks were updated and combined into one volume in 1992.

In 1996 WREEC expanded and transitioned into the Council for Environmental Education (CEE). By 2000, the activity guidebooks were further updated. Currently Project Wild receives grants and in 2002 an evaluation instrument was developed and pilot testing began. Project Wild has shown positive evaluation results; however, all of the evaluations were conducted within school settings by surveying teachers.

Most of the environmental education curricula were developed for use in a classroom setting during school hours. Thus, most research focusing on program impact has concentrated on these settings. Little, however, is known about the effectiveness of environmental education in after-school settings. The current study, utilizing an adapted version of Project Wild materials, was designed to help fill this information gap.

**Studies of Environmental Program Outcomes**

Corral-Verdugo (1993) studied the effect of providing third graders with examples of the environment for their ability to distinguish facts from opinions. The experimental group that received examples of the environment, along with environmental facts and opinions, were able to distinguish fact from opinion better than the control group that did not receive examples. The researcher concluded that environmental education programs should strive to develop critical thinking skills and avoid portraying only facts and opinions (Corral-Verdugo, 1993). No differences by gender were found.

Young children do not have the ability to think abstractly. Until the age of 10, many children view things that do not move to be dead, such as trees and nature. Margadant-van Arcken's (1989) studied kindergarten children and their relationship's

with animals. Children's first instinct is fear; however once the child builds trust, the fear is put aside. Margadant-van Arcken called this "fusion of horizons." The animal and child's relationship is based on symbiotic understanding, and so it is recommended to let the two interact freely, with appropriate adult supervision (Margadant-van Arken, 1989).

Siemer and Knuth (2001) studied whether fishing education programs had an effect on environmentally responsible behavior. A 1984 amendment to the Sportfish Restoration Act of 1950 added a 10% excise tax on tackle. These funds were used to implement fishing education programs around the country. "One of those programs is called Hooked on Fishing-Not on Drugs (HOF-NOD). HOF-NOD programs are coordinated nationally by the Future Fisherman Foundation but are implemented locally by states and other interested educators" (2001, p. 23). Siemer and Knuth (2001) sent surveys to participating schoolteachers in Arkansas, Ohio, Texas and West Virginia. They tested whether fully implemented fishing programs impacted responsible environmental behavior compared to partially implemented programs (those not including fishing trips) or no implementation. Their data show that "fishing participation whether part of formal programs or not, has the potential to influence entry-level stewardship variables" (p.28). They found that full programs were more likely to obtain interest in fishing than partial or no programs; however, very little difference was found between partial programs and no programs. "These findings suggest that brief programs or promotional events that involve no actual fishing should be regarded as mechanisms to increase awareness of fishing rather as significant life experiences that

increase environmental sensitivity" (p. 28). The actual fishing experience, whether in a program or not, was thought to be the most important aspect of creating responsible environmental behavior.

Nature on the Way to School is a Swiss program that attempts to increase perceptions of plants and animals (Lindemann-Matthies, 2002). Lindemann-Matthies researched whether students who had the program increased their perception of biodiversity on the way to school compared to students who did not have the program. Questionnaires were sent out to all the teachers who requested Nature on the Way to School materials. The teachers were asked to administer a pretest and then a posttest following the program. Teachers who ordered the program were also asked to select another class, at the same level, to act as the control group. The researcher found that, as a result of the program, students noticed an increased number of plants and animals in their environment and increased "their ability to distinguish plants and animals at the genus or species level" (Lindemann-Matties, 2002, p. 28).

Another study, conducted in Australia, questioned whether environmental education in school impacted students and their family (Ballantyne, Fien & Packer, 2001). There were two different programs evaluated in the research. The first program was specifically for primary school students. The education program was built around the lives of an aboriginal girl and white boy living in the mid-1800s. The goal was to show a link between the families and their environments. The program included visits to local centers. The second program was for secondary school students. This program was derived from DeBono's 'six thinking hats' (DeBono, 1992) in which modes of

thinking are related to a different color hat (red-emotions; yellow-good points; black - bad points; green-creativity; white-information; and blue-organization of thinking). The purpose of the program was to "1) raise students' awareness of local environmental problems; 2) develop students' understanding of the research process involved in investigating a problem; 3) encourage students to think critically about the topic of their research; and 4) develop students' presentation skills" (Ballantyne, Fien & Packer, 2001, p. 26). At the conclusion of the program, questionnaires were given to the students; teachers were interviewed and telephone interviews were conducted with parents. The study found that an environmental education program could impact students and their families to be more responsible and aware of their environment. It also showed that just because a student may like the program does not mean they will become more environmentally aware (Ballantyne, Fien & Packer, 2001).

A study was conducted in Switzerland that tested whether there was a relationship between environmental experiences, learning and behavior (Finger, 1994). Finger conducted a pilot test (n=7) to determine if individuals had changed their environmental behavior in the past ten years, and, if so why. The main factors that predicted environmental behavior were experiences such as catastrophes, activism, and experiences with nature. Environmental education had little effect on influencing behavior; however, those who were more involved in changing their environmental behavior were more educated than those who did not.

The actual study had an additional eight people. It showed that more experiences with the environment involved catastrophes and nature experiences, and that subjects

were aware and concerned with environmental issues and problems. Environmental education programs, once again, did not influence behavior; however, they did influence learning about the environment (Finger 1994).

Finger's study was conducted with adults in Switzerland. Unlike that study, the current study thinks that if children are taught about the environment at an early age, they will strive to learn more and alter their behavior towards protecting the environment.

Interpretation and environmental education are words used interchangeably in programs conducted outside of a school setting (Knapp & Poff, 2001). "Nature centers, historical sites, parks, museums, zoos, and aquaria all provide opportunities for an interpretive experience" (p. 55). Knapp and Poff studied the impact of an interpretive program during a student field trip to Hoosier National Forest. Like many other interpretive/ environmental education programs, the study tested knowledge, attitudes and behavioral intentions. The students liked the field trip, games and activities. After participating in the program, they showed little incentive to participate in environmental issues; however, the researchers attribute this outcome to low retention of knowledge. If the students had transferred the knowledge of environmental issues learned from the games and activities instead of remembering the rules or their role in the game, they might have become more knowledgeable and therefore more likely to have behavioral intentions towards helping the environment (Knapp & Poff, 2001).

Knapp and Poff's study was one of the few conducted outside the school setting, but still was a class field trip happening during school. Conducting research only with

school children creates a gap in research in that there are other places outside of schools to find samples. Schools are easy to obtain subjects, yet so are after-school programs.

**After-School Programs**

Literature was reviewed on after-school programs because the Discovery Club was offered to third graders who attended Kid's Klub, an after-school program in College Station, TX. After-school programs have been around since the development of Boys Clubs in 1860. Other organizations such as YMCA, YWCA and 4-H also sponsor after-school programs, yet today programs have become widespread and encompass a variety of support systems (Scott-Little, Hamann & Jurs, 2002).

After-school programs strive to create a safe place for youth, create a meaningful relationship with an adult, develop character and provide opportunities to experience success (Kahne, Nagaoka, Brown, O'Brien, Quinn & Thiede, 2001; Quinn, 1999; Scott-Little, Hamman & Jurs, 2002; Witt & Crompton, 1997).

**Theory of Reasoned Action**

Figure 1 showed that in Fishbein and Ajzen's Theory of Reasoned Action, behavioral intentions and behavior are a function of the attitudes toward the behavior and the subjective norms or knowledge (Eagley & Chaiken, 1993). Research shows that attitudes do not directly lead to behavior; they correspond more with the subjective norms and behavioral intentions (Ajzen & Fishbein, 1970; Ajzen & Fishbein, 1972; Ajzen & Fishbein, 1977).

Bright and Manfredo (1996) found that objective knowledge about a topic had little effect on the attitude or behavioral intentions of their subjects. They did, however,

find that emotional response (positive or negative) and symbolic belief had greater effect on the attitudes of subjects. Similarly, subjective social norm and subjective personal norm show little effect on attitude of subjects (Becker & Gibson, 1998; Ray, 1991).

Attitudes are a constant predictor of behavioral intentions (Becker & Gibson, 1998; Bright & Manfredo, 1996; Hanna, 1995; Ray, 1991). Many studies have found that attitudes and subjective norms lead directly to behavioral intentions (Gillmore, Wells, Simpson, Morrison, Hoppe, Wilsdon & Murowchick, 2002; Vallerand, Deshaies, Cuerrier, Pelletier & Mongeau, 1992). Behavioral intentions almost always lead to the behavior unless some outside force acts on the subject that is outside their control (Hanna, 1995).

Research suggests that predisposing factors of knowledge influence attitudes and behavior about wilderness (Hanna, 1995). Young children exposed at an early age may be more likely to have an attitude toward wilderness and behave in ways that reflect that attitude. Rossi and Armstrong (1999) compared the Theory of Reasoned Action to the Theory Planned Behavior to see whether the latter was more useful. Hunting behavior has been studied several different ways, yet they demonstrated that the Theory of Reasoned Action was as useful as the other theory for predicting hunting behavior. They stated that natural resource human dimension research is more often being evaluated using The Theory of Reasoned Action (1999).

Critics of the Theory of Reasoned Action claim that the causal sequence of attitude and subjective norm leads to behavioral intention, but the behavior can sometimes be blocked (Nabi & Sullivan, 2001; Sarver, 1983). Predicting behavior

depends on the context of the situation. "Under the appropriate circumstances, attitudes can reliably predict behavioral intention and, in turn, behaviors" (Nabi & Sullivan, 2001).

Ray (1991) conducted a study on third through eighth graders intentions to participate in laboratory or non-laboratory science learning. He was unable to find examples of studies that used the Theory of Reasoned Action with younger samples. "It may be that the theory is not as helpful in explaining and predicting the intentions of such young people as it is for older people who might perceive that more behavior is under their own control" (p. 157). There is not much literature on the Theory of Reasoned Action involving children, thus Ray is wary about assuming that the same impacts will occur in children that have occurred in adults.

Although these studies did not specifically use Theory of Reasoned Action, they have looked at environmental education and its impact on knowledge, attitudes and behavior (Armstrong & Impara,1991; Newhouse, 1990). In testing knowledge vs. changes in attitudes, Armstrong and Impara looked at the effectiveness of Naturescope, an education program developed by the National Wildlife Federation. Surprisingly, they discovered a difference in knowledge levels between the control group and the group who had the program, but no statistical difference in attitudes. Their study showed that program effect is diluted by a variety of teacher and student demands (Armstrong & Impara, 1991). Hopefully, by removing the program from a school setting and placing it in an after-school program, where the researcher has full control of the program's

content and presentations, the student might be more apt to learn when they know they will not be graded.

Studying attitudes and behavioral intentions from an environmental perspective has proven to be difficult (Newhouse, 1990). One reason conservationists are thought to work at saving the environment is that at one point in their life they experienced loss, whether it is cutting down a forest near a house or seeing a family of wild animals dead somewhere. Not much research has been conducted on life experience; instead researchers focus on attitude and behavioral change. "The study of specific methodologies for inducing attitude and behavioral change may help conservationists plan education programs designed to promote environmentally responsible behavior" (1990, p. 29).

In one Canadian study, (Legault & Pelletier, 2000) results indicated that the impact of environmental education programs on children and adults were not significant (Leeming, Porter, Dwyer, Cobern & Oliver 1997; Legault & Pelletier, 2000; Sutherland & Ham, 1992,). Together, these studies suggest that more research on the impact of environmental education programs must be conducted.

**Retrospective Pre-Post Testing**

One of the difficult aspects of environmental education outcomes research in an after-school program is collecting data. Because this is not a school setting, students need to feel they not are taking a test. One approach to data collection is the Retrospective pre-post test (Bennett, 1988).

Retrospective pre-post testing is based on the assumption that participants may not be able to respond accurately at the beginning of a study simply because they do not have the knowledge base (Rockwell & Kohn, 1989; Umble, Upshaw, Orton & Matthews, 2000). Thus, the methodology ask participants to answer paired questions at the end of the program with one asking what they know before the program began and the other at the completion of the program (1989, 2000).

In Retrospective pre-post test, "the data collection instruments are relatively easy to develop, use, and analyze" (Rockwell & Kohn, 1989, p. 1). However, the researcher must be careful administering the test because if answers are placed in the wrong column, the test is useless (Webb & Molgaard, 2003). According to the program evaluation of the Iowa State Extension Strengthening Families Program the survey should be administered in the following way:

1. Before handing out the surveys, use strips of paper to cover the second column so that respondents can only see the first column.
2. Read each item out loud and ask participants to circle the appropriate response, rating their behavior NOW.
3. After all items are read; have them turn back the strip of paper to reveal the second column.
4. Read each item again, asking participants to rate their behavior BEFORE the program.

5. When reporting findings results using the retrospective pre-post-, be sure to clearly describe that participants are rating their own degree of change (Webb & Molgaard, 2003, ¶ 9).

# CHAPTER III

# RESEARCH METHODOLOGY

This chapter discusses the methods that were used to conduct the study. It includes information about the: (1) study setting, including the Kids Klub and Discovery Club programs, (2) questionnaire development, (3) selection of the subjects, (4) variables, (5) pilot test, (6) study time line, and (7) statistical approach to hypotheses.

## Study Area & Participants

Texas A&M University's Internal Review Board approved the study in February 2003, and the College Station Independent School District in August 2003.

The study was conducted at five elementary schools in College Station that offer Kids Klub programs. The Discovery Club program was offered at schools A and B, while schools C, D and E served as the control schools. The decision to use schools A and B as program sites was made jointly by the Kid's Klub director and the researcher. The program schools were chosen because the researcher had worked previously with the program directors at both schools. These schools also had larger enrollments of third graders than the other Kids Klub sites, thus increasing the probability of a larger study sample.

Third grade students from the other three schools, who participated in Kid's Klub, were used as controls, rather than using third graders not participating in the Discovery Club at the program sites. This procedure was necessary since there were not enough third grade students at Schools A and B to split into a program and a control group.

Parents were asked to sign a consent form before their children could participate in the Discovery Club. Children also were asked to sign an assent form saying they knew this was a research project and they wanted to participate (Appendix A).

**Discovery Club Program**

The Discovery Club was an environmental education program that took place outside the conventional classroom during Kid's Klub. The researcher created the program to increase environmental knowledge, attitudes, and behaviors of third grade children. The researcher chose to offer the Discovery Club as part of Kid's Klub because Kid's Klub was a stable program, having existed since 1989, and the staff had a strong history of working on projects with faculty and students from Texas A&M. The Kid's Klub Director and staff were open to opportunities to increase program variety for Kid's Klub participants.

Efforts were made so that the children would not feel that participating in the Discovery Club was simply more school. Thus, the Discovery Club consisted of a series of hands on activities incorporated into educational programs designed to promote participants' environmental awareness.

The lesson plans used in this study were developed based on a variety of sources, e.g., Project Wild and Aquatic Wild resources (Council for Environmental Education, 1999), and the environmental background of the researcher. The researcher was Project & Aquatic Wild certified. Project Wild (Council for Environmental Education, 1999) is a series of hands on environmental education activities developed specifically for grade

K to12 students. The individual activities help develop knowledge for academic standards while using engaging hands on activities.

The researcher was certified to offer the Project and Aquatic Wild program. Knowledge of this program and its potential for influencing children's environmental knowledge, attitudes and behaviors led to the decision to use the content of Project and Aquatic Wild as the key building block for the Discovery Club curriculum. After deciding which topics to cover, the researcher reviewed Project Wild materials (2000) to select standardized activities that could be usefully included in the Discovery Club curriculum. Other content was added to the curriculum based on the past experiences of the researcher. Eight lesson plans (Appendix B) were developed covering water, land/habitat, recycling, insects, fish, amphibians, reptiles, birds and mammals.

Where appropriate, live animals were used to enhance the lessons presented. These were borrowed from private individuals in College Station. Preserved species were borrowed from the Texas Cooperation Wildlife Collections in College Station, TX and the Entomology department at Texas A&M University.

On Discovery Club days, the researcher arrived at the school at 4:15 p.m. The next 15 minutes were devoted to setting up activities for that day. Each lesson began at 4:30 p.m., and took 45 to 60 minutes to present. The researcher presented one of the eight lessons at each of the two program schools each week.

A survey was administered to program participants during the week after the program had been completed (Appendix C). While handing out surveys, the researcher explained the directions and asked the students to fill it out as best they could. The

researcher told the students that their answers to the survey questions would not be graded. The survey was given at the beginning of the session to give students as much time as possible to complete it before parents began to pick them up. After giving the students time to complete the surveys, the researcher gave out cupcakes and small plastic animals as a thank you for participating in the study. The researcher also talked about any of the subject areas covered during the Discovery Club that the students wanted to discuss. The researcher ended the day with a short debriefing about the research and thanked the students for participating.

A consent form was sent home to parents of the students in the control group at schools C, D & E. During the same week that surveys were administered to children participating in the program, surveys were administered to the control group students whose parents had returned the consent forms. These students were also given cupcakes and plastic animals.

**Pilot Test**

A pilot test of the program was conducted from August 2002 to April 2003. The test period helped develop the lesson plans, test their applicability to third graders, and determine the response of the children to the lesson plans. During the pilot test period, input from students was sought to help the researcher create survey questions in a language they could understand. Nine lesson plans were used during the pilot test period (Figure 2). The lesson plans were presented every other week at two target elementary schools. Each lesson lasted between 45 to 60 minutes.

After the pilot test, efforts were made to determine which lessons had worked better than others. Several criteria were used to determine if the lessons were successful, including the amount of time the leader spent talking and leading discussions versus doing hands on activities, and the reaction of the children during the lesson. For example, were they talking to each other and saying things such as “I’m bored.” Finally, the children were asked if they had a good time the day a particular lesson was presented and also asked what they would change about the presented lesson.

The lesson plans on land and air were the least successful. The children enjoyed making leaf prints, but there was too much discussion and not enough student involvement. The reptiles/ amphibians and bird lessons held the students’ attention more than the others because the children controlled their own learning and live animals were used as part of the demonstrations. Once the pilot test was completed, final lesson plans were developed based on feedback received from the students.

Water: The program began with a discussion about water including questions: What are the two types of water: What are different forms of salt and fresh water? Water conservation and pollution was discussed. For the activity, water was filled about half way up an aquarium and a line was drawn at the water level. The students took a sponge and dipped in the aquarium full of water every time they thought of a way water was wasted. After they could not think of any more ways to waste water, a line was drawn around the new water level. After thinking of a way to conserve water, the students dipped the sponge into the bucket on the side and added the water back into the aquarium. Foe pollution, the students thought of ways water was polluted and then added vegetable oil and food coloring to a separate bowl of water.

Air: The students were given "air bags", Ziploc bags filled with a balloon, straw, Styrofoam ball and feather. Their job was to investigate properties of air with the tools given. A discussion followed with demonstrations of the student's discoveries about air.

Land: We began with a discussion of types of land and terrain. We showed pictures of natural terrain in the Bryan/ College Station area. Leaves from Bryan/ College Station were passed around and the students tried to identify the trees they came from. Finally, the students made leaf prints with colors.

Recycling: A discussion began about the difference in recycling and reusing. Different household items, such as milk jugs, aluminum cans, egg cartons and butter tubs were placed on the table. The students took turns looking at each item and thinking of ways to reuse the items. We played a game called not in my backyard. At the end, the students were handed an index card and asked to put the phone number of the recycling center in College Station. After that they decorated the card with items that could be recycled.

Insects: This game was an adapted version of Insect gravity in Project Wild (1999). Crickets were brought in for students to look as and talk about the parts of an insect's body. Different insects found in the Bryan/ College Station area were discussed. Many preserved insects (courtesy of the Texas A&M Entomology Department) were brought to show students.

Fish: An activity from Aquatic Wild (1999) was used. The students drew cards from five stacks of adaptations. The object was for the students to make fish and name it by using five different adaptations of body size, shape, mouth type, reproduction style and habitat. The students showed off their fish and discussed why the adaptation was useful to that fish.

Amphibians/ Reptiles: A game called minefield was adapted from the original outdoor education game. In this version, students were sent on a mission to rescue all the amphibians and reptiles (fake) the aliens kidnapped. A discussion of the characteristics of amphibians and reptiles followed the game. During the discussion snakes, snakeskin and a turtle shell was shown.

Birds: An activity demonstrating the adaptations of bird beaks from Project Wild (1999) was done. Different stations were set up and the students went out to each station and used different tools to pick up items (ex., rice on a log, raisins at the bottom of a pail and popcorn in an aquarium). The tool related to the type of beak the bird had. Then, the students tried to match a specific bird to that type of beak. Finally, the correct answers were given and preserved examples of a few types of birds were shown.

Mammals: Oh Deer from the Project Wild (1999) book was played. A discussion of the need for food, water, and shelter followed the game. Students talked about the difference between mammals in the area and the domestic mammals they own. Pelts of white-tailed deer, Mexican free tailed bat, and red squirrel were shown. Skulls of each were also presented.

Figure 2: Pilot Test Lesson Plans

**Pilot Test Data Collection Instrument**

Following each lesson plan in the pilot study, notes were taken on specific topics covered during the day. Possible questions were developed from these notes to determine if the units impacted student's knowledge, attitudes and behavior. The questions were revised and rewritten in language appropriate to third graders. For example, a game was played about why birds have different beaks, so a possible question was to ask the children to identify what a bird with a specific type of beak might eat.

The questionnaire used questions with Likert-type question response format, open-ended questions, and multiple choice response format. There were four knowledge questions about each of the nine subject areas. Each question was written specifically from the lesson plan taught. There were five questions each about attitude and behavioral intentions.

The open-ended questions asked the subject what they liked and disliked about the Discovery Club. Responses to these questions helped provide supplemental information about what students had learned through their participation in the program. The information was used to improve the program mechanics and presentation of the lesson plans.

There were also three questions about student's satisfaction with the Discovery Club: Did you like the Discovery Club?; Would you like to participate in another similar program?; and Would you recommend the program to other third graders? (P. A.

Witt, personal communication, April 7, 2003). These questions had a five point Likert-type response format.

The questionnaire was developed using a retrospective pre-post test format (Pratt, McGuigan& Katzev, 2000). Subjects were first asked to recall their attitudes and behavior after participation in the program and then indicate their attitudes and behaviors before their participation in the program. This procedure was thought to be useful since it avoided collecting pre-test data from students who might drop out of the program or post-test data from students who entered the program after the pre-test had been completed. Using the retrospective pre-post test data collection procedure and keeping track of attendance were thought to be the best ways to insure a reasonable sample size for data collection at the end of the program.

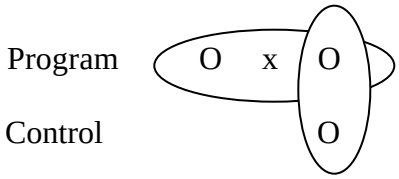
**Data Collection Instrument**

After using the pilot test questionnaire, it was abandoned because the language level was still too difficult for third graders. The questionnaire was rewritten in language that was easier to comprehend. Three questions were related to attitude and three questions related to behavior for each of the subject areas of recycling, water, mammals, reptiles/amphibians, birds, insects, fish and habitat/wildlife. Each question used a five-point Likert-type scale response format. Twenty-four multiple choice questions covering all the subject areas were used to test the students' knowledge. Three satisfaction questions were written using a five-point Likert-type scale and two opened ended questions asked the students' favorite and least favorite part of the Discovery Club. The questionnaire was read and edited by three graduate students who had

experience working with youth. The revised questionnaire was then piloted with ten students from schools C & D who did not participate in Kid's Klub. Based on comments from the pilot group, the wording of the questionnaire was further revised before being used in the actual study.

**Data Collection Procedures**

The test group from Schools A & B received the retrospective pre-program, post-program format questionnaire while the control group from schools C, D & E only received the post-program portion of the instrument.




**Time Line**

The actual study began in September 2003. Consent forms were sent home for parents to sign and return in a self-addressed stamped envelope. The Discovery Club program was then presented over the next eight weeks. In week nine, the survey data were collected.

**Data Analysis**

The study had five hypotheses. The following were the statistical analysis procedures related to each hypothesis.

H1: Students who are satisfied with the program will show higher levels of knowledge about the program. Satisfaction scores were added together and divided by the total to obtain the mean. A total score for knowledge questions was calculated based

on the number of items each student answered correctly. Pearson's Bivariate Correlation was run to obtain the correlation between increases in knowledge and satisfaction level.

H2: Students who participate in the program will show significant changes in their attitudes and behavioral intentions toward the environment. Attitude item and behavior item means were calculated for both pre-program and post-program variables over all unit areas combined and for each unit area separately. For the program group, paired t-tests were conducted using the pre-program and post-program scores for each of these means. These t-tests were used to measure the change in mean scores over total attitude and behavior responses, attitude-only responses, behavior-only responses, individual responses per subject area and individual responses per subject area after controlling for actual attendance for each of the program sessions.

H3: Students who participate in the program will increase their knowledge in the subject areas of water, air, land, recycling, fish, insects, amphibians, reptiles, birds and mammals compared to students who do not participate in the program. Knowledge means were calculated by adding all correct answers and dividing by the total number of questions. An independent t-test was run to determine significant differences in mean knowledge scores for the program group compared to the control group.

H4: Students who participate in the program will show significant changes in post-test attitudes and behavioral intentions toward the environment compared to students who do not participate in the program. Post-test attitude and behavior means were calculated over all unit areas combined, attitude items only, behavior items only

and for each unit area separately for the program and control groups. T-tests were then conducted between the program and control group post-test scores.

H5: Students in the program group who have more post-program knowledge will have significant changes in post-program attitudes and behavioral intentions. Correlations were analyzed between total means for knowledge, attitudes and behavior using Pearson's Bivariate Correlation.

**Summary**

Over a one-year period, the researcher developed eight lesson plans, which were then used to conduct the program. The lessons included units on water, air, land, recycling, insects, fish, amphibians, reptiles, birds and mammals. A pre-post test retrospective questionnaire was developed to determine changes in the participant's attitudes and behavioral intentions as a result of participating in the program. The questionnaire also contained questions about the participant's knowledge at the end of the program. Third graders from three schools where the program was not presented served as the control group.

# CHAPTER IV

## RESULTS

A survey was administered at the end of the Discovery Club to program participants at the two schools where the program was conducted and students from the three other schools that served as the control group. All students were in the third grade. For the program group, thirteen (65.0%) were female and seven (35.0%) were male. Gender statistics were not recorded for the control group, though males outnumbered females.

Survey data were entered and analyzed in SPSS. After data entry, the data for six negatively worded questions were transposed. These six questions were 1) I think all bugs are bad, 2) I am scared of insects, 3) I like to touch mammals even if I don't know them, 4) I am scared of snakes, 5) I would throw rocks at a fish, and 6) I would touch a squirrel if it came up to me.

Thirty program group students and thirty-one control-group students completed surveys. However, eleven surveys were eliminated before the data entry process. Two students checked the same answer on each page. One student checked more than one box for each question and did not finish the survey. Parents picked up three of the students before the students finished completing the survey. Five students only attended one Discovery Club session and their data were disregarded. Thus, there were 20 program group surveys and 30 control group surveys available for analysis.

For the program group, pre-test and post-test scale scores for each student were calculated for the attitude and behavior items by adding all the attitude item responses

and then the behavior item responses and each dividing by the number of items actually filled out for each component. A total scale mean for all behavior and attitude items combined was also calculated for the pre-test and post-test items. Means were calculated in a similar manner for the control group. In a few cases students did not provide an answer for a given item so the number of items for the particular scale was reduced when determining the mean. In no case did students fail to answer more than one item for a given scale.

**Satisfaction**

H1: There will be a positive relationship between students who are satisfied with the program and their knowledge level.

The correlation between the knowledge score (total number of items correct) and program satisfaction score (mean satisfaction rating) was -.045 (*n = 20, p = .852*) and therefore statistically non-significant.

**Program Attitude and Behavior**

H2: Students who participate in the program will show significant changes in their attitudes and behavioral intentions toward the environment.

A paired t-test was run using the pre-test and post-test mean scores for the program group. Separate t-tests were run using the total mean scores (attitudes plus behavioral intentions across all eight subject unit areas), total scores for each subject area (attitudes and behavioral intentions combined), and separate attitude and behavioral intention mean scores for each subject area. Effect sizes were also calculated using Cohen's D formula. An effect size indicates the degree to which one variable is related

to the other (Hopkins, 2000). In this study, if significant results occurred, the effect sizes indicated where there was a meaningful relationship between the program and outcomes.

Results indicated that the total after program mean (*M = 3.85*) was significantly higher than total before program mean (*M = 3.51*) (*t = 2.20, df = 19, p = .04: ES = .46*) (Table 1 & Figure 3). T-tests were also run after separating the attitude and behavior questions into separate variables. For the program group, the behavior mean was significantly higher after completion of the program (*t = 2.24, df = 19, p = .04: ES = .41*), and higher for attitudes, but not statistically significant (*t = 1.97, df = 19, p = .06: ES = .47*) (Table 1 & Figure 3).

Table 1

*Comparison of Pre- and Post-Test Means for Program Group*

| **Program Group Scales** | **Pre Mean** | **Post Mean** | ***N*** | ***df*** | ***t*** | ***sig*** | **Effect Size** |
|---|---|---|---|---|---|---|---|
| Total Attitude and Behavior items* | 3.51 | 3.85 | 20 | 19 | 2.20 | 0.04 | 0.46 |
| Total Attitude Scale | 3.67 | 4.01 | 20 | 19 | 1.97 | 0.06 | 0.47 |
| Total Behavior Scale* | 3.36 | 3.70 | 20 | 19 | 2.24 | 0.04 | 0.41 |
| Recycling Scale | 3.55 | 3.84 | 20 | 19 | 1.19 | 0.25 | 0.27 |
| Water Scale* | 3.27 | 3.92 | 20 | 19 | 2.46 | 0.02 | 0.55 |
| Fish Scale | 3.76 | 3.85 | 20 | 19 | 0.35 | 0.73 | 0.02 |
| Insects Scale | 3.34 | 3.76 | 20 | 19 | 1.74 | 0.10 | 0.38 |
| Bird Scale* | 3.42 | 3.93 | 20 | 19 | 2.49 | 0.02 | 0.51 |
| Reptiles/ Amphibian Scale | 3.41 | 3.62 | 20 | 19 | 0.79 | 0.44 | 0.20 |
| Mammals Scale | 3.53 | 3.65 | 20 | 19 | 1.11 | 0.28 | 0.18 |
| Habitat Scale* | 3.78 | 4.29 | 20 | 19 | 3.55 | 0.00 | 0.65 |

* Scales significant, $p<0.05$.

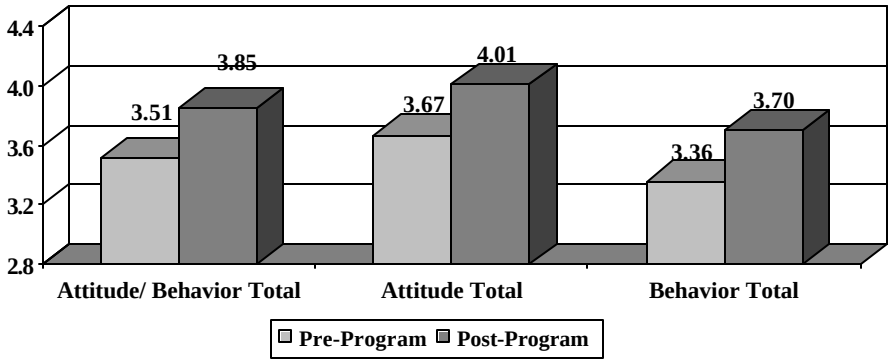



Figure 3: Graph Comparing Pre- and Post-Test Overall Means

An additional set of paired t-test analyses was run to determine pre- and post-test differences for the program group for each separate lesson plan area. After completion of the program, post-program means were significantly higher than the pre-program means for the curriculum areas: water (*t = 2.46, df = 19, p = .02: ES = .55)*, birds (*t =2.49, df = 19, p = .02: ES = .51*), habitat and wildlife (*t = 3.55, df = 19, p = .00: ES = .65*). The means for recycling (*t = 1.19, df = 19, p = .25: ES = .27)*, fish (*t = .35, df = 19, p = .73: ES = .02*), insects (*t = 1.74, df = 19, p = .10: ES = .38*), reptiles and amphibians (*t = .79, df = 19, p = .44: ES = .20*) and mammals (*t = 1.11, df = 19, p = .28: ES = .18*) increased from the pre-program to post- program, however the increases were not statistically significant (Figure 4 & Table 1).

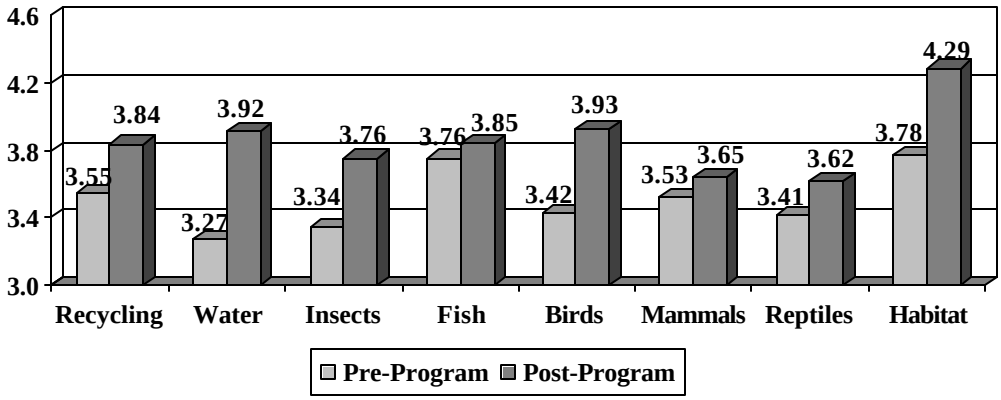



Figure 4: Graph Comparing Pre- and Post-Test Individual Lesson Means

Some children did not attend all of the program sessions. Thus, although they provided pre- and post-test responses for all questions, they actually may have not attended for a given session and their answers to questions for that area might have impacted the meaningfulness of the results (Table 2). For example, attendance for the reptiles and amphibians session was low (10 of the 20 children attended), perhaps because students did not like or were scared of amphibians and reptiles. Other program days with a smaller attendance were water (*n=15*) and insects (*n=14*). The water unit occurred during week two and did not seem to spark student interest. Attendance for the insect session was also low due to a change in program day at one of the schools because of a conflicting Kid's Klub event. The rescheduled day fell on Halloween and many parents picked up their children early so they could go trick-or-treating before dark.

Table 2
*Attendance by Program Subject Area*

| Subject | Attendance |
|---|---|
| Recycling | 18 |
| Water | 15 |
| Fish | 17 |
| Insects | 14 |
| Bird | 17 |
| Reptiles/ Amphibian | 10 |
| Mammals | 17 |
| Habitat | 19 |

A second set of paired t-test analyses was run to determine differences between pre-program and post-program scores after controlling for actual program attendance. After completion of the program, post-program means were significantly higher for the habitat and wildlife lesson (*t = 3.97, df = 18, p = .00: ES = .71*) (Figure 5 & Table 3). Although not statistically significant, post-program means also were higher for six of the seven other lessons: recycling (*t = .86, df = 17, p = .40: ES = .24*), water (*t = 1.65, df = 14, p = .12: ES = .46*), fish (*t = .17, df = 16, p = .87: ES = .04*), insects (*t = 1.12, df = 13, p = .28: ES = .32*), birds (*t = 1.73, df = 16, p = .1: ES = .41*), mammals (*t = 1.49, df = 16, p = .16: ES = .22*). Differences for reptiles and amphibians (*t = -.54, df = 9, p = .61: ES = -.18*) were negative, though statistically non-significant, from the pre-test to the post-test (Figure 5 & Table 3).

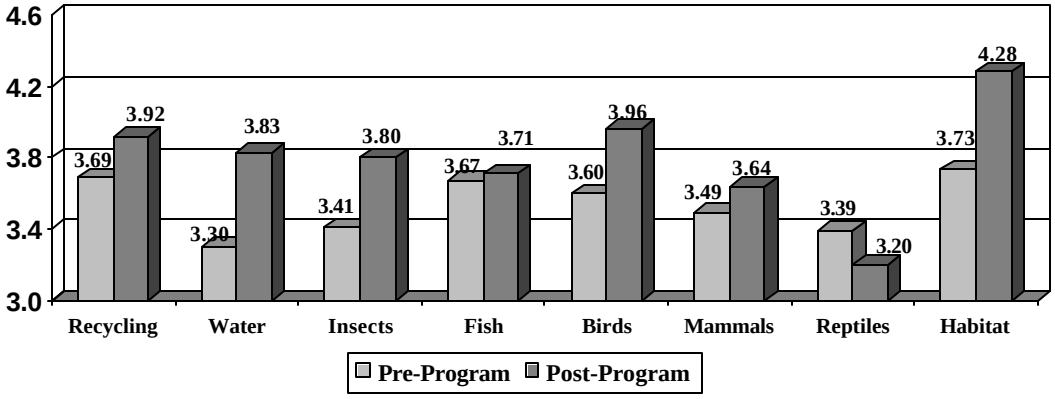



Figure 5: Graph Comparing Pre- and Post-Test Individual Lesson Means/ Attendance

Table 3
*Comparison of Pre-and Post-Test Means for Program Group Controlling for Actual Attendance*

| **Comparing Before vs. After Performance (attendees only)** | **Pre Mean** | **Post Mean** | ***N*** | ***df*** | ***t*** | ***sig*** | ***ES*** |
|---|---|---|---|---|---|---|---|
| Recycling Scale | 3.69 | 3.92 | 18 | 17 | 0.86 | 0.40 | 0.24 |
| Water Scale | 3.30 | 3.83 | 15 | 14 | 1.65 | 0.12 | 0.46 |
| Fish Scale | 3.67 | 3.71 | 17 | 16 | 0.17 | 0.87 | 0.04 |
| Insects Scale | 3.41 | 3.80 | 14 | 13 | 1.12 | 0.28 | 0.32 |
| Bird Scale | 3.60 | 3.96 | 17 | 16 | 1.73 | 0.10 | 0.41 |
| Reptiles/ Amphibian Scale | 3.39 | 3.20 | 10 | 9 | -0.54 | 0.61 | -0.18 |
| Mammals Scale | 3.49 | 3.64 | 17 | 16 | 1.49 | 0.16 | 0.22 |
| Habitat Scale* | 3.73 | 4.28 | 19 | 18 | 3.97 | 0.00 | 0.71 |

* Scales significant, $p<0.05$.

**Program Group vs. Control Group**

H3: Students who participate in the program will increase their environmental knowledge compared to students who do not participate in the program.

A total score was created for the number of correct answers across all 24 environmental knowledge questions. Chi-square analyses were run to determine differences in knowledge scores between the program group and the control group at the completion of the program (Appendix D). An independent t-test was run to compare the program versus the control group, and effect sizes were calculated. Although not statistically significant, the mean score for the number of correct knowledge question answers was higher for the program group (*Program M = 19.30, Control M = 16.50, F = 1.44, df = 48, p = .24: ES = .58*) (Table 4).

H4: Students who participate in the program will show significant changes in post-test attitude and behavioral intentions toward the environment compared to students who do not participate in the program.

Total means were calculated for program and control group using independent t-test. Attitude and behavior were separated and the means of each were calculated. Although not significant, positive changes occurred in the total mean score (*Program M = 3.85, Control M = 3.8, f = .43, df = 48, p = .52: ES = .10*) and behavior (*Program M = 3.70, Control M = 3.51, F = .04, df = 47, p = .85: ES = .27*) while a non-significant negative change occurred in attitude scale (*Program M = 4.01, Control M = 4.06, F = .57, df = 48, p = .45: ES = -.10*) (Figure 6 & Table 4).

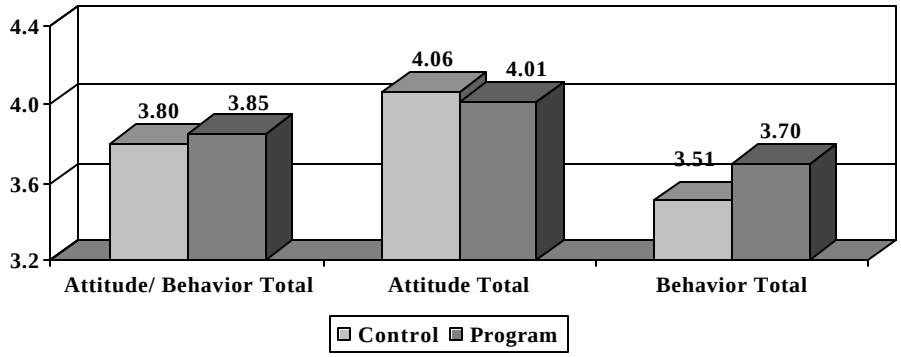



Figure 6: Graph Comparing *Program vs. Control Overall Means*

Table 4
*Comparison of Program and Control Group Means*

| Scales Tested | Control N | Program N | Control Mean | Program Mean | *df* | *F* | sig | *ES* |
|---|---|---|---|---|---|---|---|---|
| Total Program Scale | 30 | 20 | 3.80 | 3.85 | 48 | 0.43 | 0.52 | 0.10 |
| Total Program Attitude Scale | 30 | 20 | 4.06 | 4.01 | 48 | 0.57 | 0.45 | -0.10 |
| Total Program Behavior Scale | 29 | 20 | 3.51 | 3.70 | 47 | 0.04 | 0.85 | 0.27 |
| Total Knowledge Correct Scale | 30 | 20 | 16.50 | 19.30 | 48 | 1.44 | 0.24 | 0.58 |
| Recycling Scale | 30 | 20 | 3.63 | 3.84 | 48 | 0.05 | 0.83 | 0.24 |
| Water Scale | 30 | 20 | 3.70 | 3.92 | 48 | 0.15 | 0.70 | 0.26 |
| Fish Scale | 30 | 20 | 3.58 | 3.85 | 48 | 0.00 | 0.98 | 0.28 |
| Insects Scale | 30 | 20 | 3.92 | 3.76 | 48 | 0.82 | 0.37 | -0.18 |
| Birds Scale | 30 | 20 | 3.47 | 3.93 | 48 | 0.74 | 0.40 | 0.46 |
| Reptiles/Amphibians Scale | 30 | 20 | 3.75 | 3.62 | 48 | 0.01 | 0.92 | -0.12 |
| Mammals Scale | 30 | 20 | 3.69 | 3.65 | 48 | 0.98 | 0.33 | -0.04 |
| Habitat Scale | 30 | 20 | 4.13 | 4.29 | 48 | 0.57 | 0.45 | 0.25 |

The same mean calculations were used to compare the program and control groups. These means were compared using an independent-samples t-test. Non-significant positive mean changes occurred in recycling (*F = .05, df = 48, p = .83: ES =*

*.24*), fish (*F = .00, df = 48, p = .98: ES = .28*), water (*F = .15, df = 48, p = .70: ES = .26*), birds (*F = .74, df = 48, p = .40: ES = .46*), and habitat/ wildlife (*F = .57, df = 48, p = .45: ES = .25*) when comparing control vs. program groups after the discovery club was over (Table 4 & Figure 7). Insects (*F = .82, df = 48, p = .37: ES = -.18*), mammals (*F = .98, df = 48, p = .33: ES = -.0*) and Reptiles/ amphibians (*F = .01, df = 48, p = .33: ES = -.04*) showed non-significant negative changes from the control to the program group (Table 4 & Figure 7). Those two areas had the lowest means for the program group.

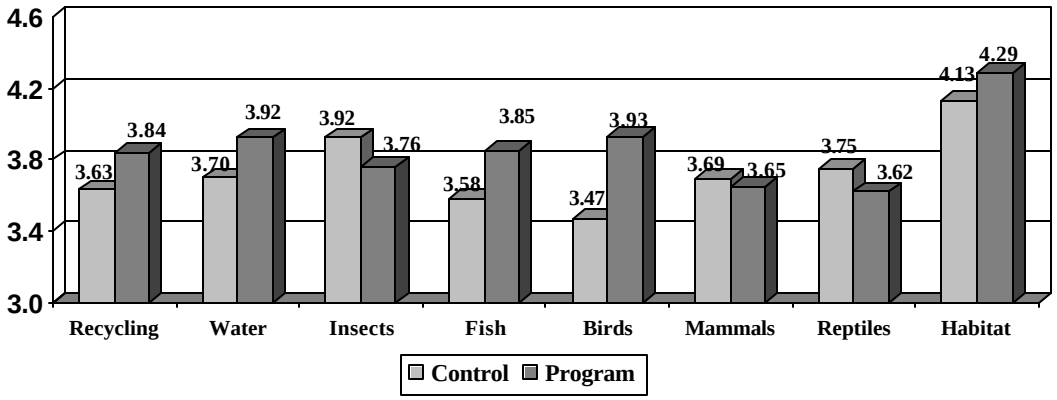



Figure 7: Graph Comparing Pre- and Post-Test Individual Lesson Means

**Program Knowledge**

H5: Students in the program group who have more post-program knowledge about the program will have significantly higher post-program attitudes and behavioral intentions.

Correlations between knowledge, attitude and behavior means were calculated for the program and control samples. The students in the program group sample had a correlation of .065 (*n = 20, p = .706*) between knowledge and attitude, a correlation of -.038 (*n = 20, p = .874*) between knowledge and behavior, and significant correlation of .683 (*n = 20, p = .001*) between attitude and behavior. The students in the control group sample had a correlation of .091 (*n = 28, p = .644*) between knowledge and attitude, a correlation of -.135 (*n = 28, p = .493*) between knowledge and behavior, and a significant correlation of .462 (*n = 29, p = .012*) between attitude and behavior.

**Interview Data**

Interviews were conducted with three students from each program school and one teacher from each of the program and control schools. The interviews with the teachers were conducted to determine whether they were already offering programs about the environment. If the schools incorporated environmental topics in the curriculum, then results obtained might not be attributable to the Discovery Club program alone. Similarly, students were interviewed to see if there were other places outside of school, such as at home, that they were learning about the environment.

The six students interviewed at the program schools indicated that they had not participated at school in anything like the Discovery Club. One child said that she thought they were about to do something on the environment, two students stated that they recycle at home and a little at school, and one said he began recycling during the Discovery Club. He also stated that he learned a lot from attending the program. Five students mentioned they talked to their parents more about the environment after the

program than before. All students said they loved coming and would not change anything about the program. Four of the student's favorite activity was the food chain game. In the food chain game, each student had four to five cards with plants or animals on them and their job was to take other student's cards based on what their plants/animals ate.

The teachers indicated that they did not do anything like the Discovery Club in their classrooms. Teachers from Schools A and B (program) and School C (control) all stated they would be doing programs such as plants, animals, habitats and competition for resources in the spring. School A did projects on the solar system. School B did a 100-cup water demonstration that was similar to, but not quite the same as, the Discovery Club. Comments were made by students that the Discovery Club water day was exciting and better than the water demonstration they had done in class. Finally, the teachers had recycling boxes for paper in their classrooms and tried to influence the students to recycle. However, they did not emphasize reusing items.

**Notes**

Journal entries were made after each program day. Notes were taken following each lesson for what had worked well and improvements that needed to be made.

**School A**

On the recycling day, this group was large enough to split into three groups for habitrekking. A Kid's Klub counselor worked with one group while the researcher helped all three. There was chaos between all the groups and some students did not know what evidence they were looking for. If the large group is split into three, there

needs to be an adult with each group. All of the students picked up trash but did not seem to make the connections between humans and wildlife until prompted. The students enjoyed making birdfeeders. After finishing, they were walking around showing the counselors their birdfeeders.

Water day was a tough day. It rained all day so an alternative indoor room suitable for getting a bit wet, had to be found. The students had a lot of energy and did not want to sit and do water experiments. The Kid's Klub counselor did not help control the students. There were a lot of students and all of them would not fit around one table, so it was hard for some to see. They became more interested when they were given their own cup with which to conduct experiments.

The students loved playing Ultimate Being on fish day. Seeing the connection between the number of eggs laid and the number of fish that live to adult size was easier with a large group. The students drew the specified fish adaptations well but did not want to share markers with each other. These students also had trouble understanding the word adaptation.

Catching insects was exciting for the students. Some daring students went for the wasps and bees while others stuck with grasshoppers and other small insects. Once again sharing was an issue since there were only three different devices to catch insects. Students mentioned that they were reusing their milk cartons. They had fun and wanted to keep the insects instead of releasing them, which created an opportunity to talk about preserving wildlife for the enjoyment of others.

Placing all the bird stations in one row made the activity easier. The group was large and there were too many students at each station. It was hard for each student to get a chance to do all the stations in a short period of time. These students made a huge mess, and did not seem to care that they were messing up the researcher's equipment. They made connections between the bird beaks and the actual birds shown. Comments such as "Are those birds real," "those birds are cool," "can we touch them," and "this is fun" were made.

On reptile day the large group worked better for minefield. There was no counselor helping, but the students were on their best behavior. They enjoyed the game saying things like "this is cool," "can we play again," and "this is so fun." The turtle was set on the ground for the students to view. The entire group sat quietly and waited for the turtle to come out and walk on the ground. The toad was held up and discussed while everyone sat quietly and watched. The students were allowed to touch the turtle but not the toad. After seeing the animals and discussing the differences between amphibians and reptiles, the students begged to play minefield again.

Once again the larger group worked better for Oh'deer and the carrying capacity activity on mammal day. The animals were kept out of sight so the students would pay attention to the activity. The students were acting up a bit and were told they would not get to see the animals. After their behavior improved and it was clear they understood the concepts, the animals were brought out. The students had fun with the dog and guinea pig. It was easy to teach the characteristics of a mammal using the live animals.

The Into the Forest card game did not go over well with a large group. There were only enough cards for each student to have two, maybe three, and that made it hard to play. The researcher split the group in half and it made the game easier to understand. The cards were used to discuss what animals lived where and that went well.

The survey went better at School A. The students were separated and instructed to complete the first three pages and then move to the next table where the researcher individually explained how to answer the before question section. In the future it might be good to copy each section in a different color. The students loved the cupcakes and toys and were very sad the Discovery Club was over.

**School B**

The program began with recycling and it went well. The students enjoyed picking up trash outside. There were not enough students to split into three groups so the activities were done as a group. Students tried to see connections between wildlife and humans. The students cleaned up the entire field and knew they were making the school playground a cleaner place. They even asked to go out again and pick up more trash. The students understood the difference between recycling and reusing and said they had a fun day.

Water day went even better than recycling. It was a beautiful day and the demonstration was done outside. At the beginning of the day the students thought they were doing the same 100-cup water demonstration they had done in class. By the end of the activity they were saying “this is so cool,” “this is better than we did in class,” and “wow, I like doing this.”

The students were not excited about fish. The game got the students involved, but the students had difficulty making the connection between the game and a salmon's life cycle. That might have been because salmon are not indigenous to this area. "Adaptation" again was a difficult word for the students to understand, and it took demonstrations to show what the word meant. The students enjoyed drawing fish, but were a little shy about showing their drawings.

Insect week went awry at this school. The original day for Discovery Club was changed due to a festival occurring at Kid's Klub. Weather played havoc and there was no chance to go outside and catch insects. Alternative insects were used to investigate and discuss and the students played charades; however, it was not as effective as them catching their own insects.

Bird day was one of the best days. Using two tables, as opposed to one, for the stations made it confusing for the students to find the station they were looking for. It was difficult for the students to relate the tool they were using to the bird beak, but, with assistance, they figured out the answers. The students appreciated the birds that were shown following the activity, and were able to recognize what food the bird ate by the shape of their beak.

One weekend the researcher ran into one of the students at a local restaurant. The student asked if they were having Discovery Club the following week and was very excited about amphibians and reptiles. The student was also excited about introducing his parents to the researcher.

Amphibians and reptile day did not go well. The only space available was on the stage, and the students acting up a bit. However, with the threat of not letting them participate, everyone shaped up and had fun. A small incident happened when a student dropped the turtle being passed around. The turtle was not injured, but from that point on no animals were held by students.

It was a beautiful day to go outside and discuss mammals; however, it was difficult to get the students to pay attention to the activity due to the animals being visible. The students understood the concept of carrying capacity and how uncomfortable it is to be extremely close to someone. They liked the activity but could not wait to interact with the animals. Some students wanted the researcher to stay at Kid's Klub with the animals until their parents came to pick them up.

The students really got involved in the food chain game. We talked about where the animals lived and about prey and predator. They had fun learning what animals eat each other. They even wanted to play more rounds than planned. They asked where the game was sold so they could buy it and play at home.

The survey went well. The students were separated from each other and the survey was explained. Two students obviously did not care and were just checking the same box down the row. It seemed as though some students had a hard time understanding how to answer the before questions when they finished the after questions. This was changed when presented to the School A group. The students were sad the Discovery Club was over and were hugging the researcher and begging her to come back.

# CHAPTER V

# DISCUSSION

## Summary of Study

The purpose of this study was to measure whether the Discovery Club, an after-school environmental education program based on modified Project Wild materials, positively impacted third graders environmental knowledge, attitudes and behavioral intentions. Eight lesson plans were developed and used once a week over eight weeks to present a program to third graders who attended Kid's Klub at two elementary schools in a Texas City. A pre-post retrospective format survey was developed to determine whether program participants increased their environmental knowledge, attitudes and behavioral intentions as a result of participating in the Discovery Club program. The survey was also used to determine if program participants' knowledge, attitudes and behavioral intentions significantly differed after the program was completed from third graders at three other schools where the program was not presented.

Detailed notes were made after each Discovery Club session to help document the impact of the individual lessons and which might need to be revised in the future. Third grade teachers were interviewed at both the program and control schools to determine whether the students had received environmental education programs as part of the regular school day.

Results indicated positive shifts in knowledge, attitudes and behavior for the program group, although many of the changes were not statistically significant. When results for the program group were compared to the control group, similar shifts

occurred. However, in several cases the post-test means for the program group were lower than the control group. In this chapter the study results are discussed, followed by discussion of problems with the study design and possibilities for designing a new study.

**Discussion of Results**

All students indicated satisfaction with the program. Seventy-five percent (75.0%) of the students averaged 5.0 (on a scale of 5) over the three satisfaction questions indicating a high degree of satisfaction with the program. There was not a significant relationship between participant's satisfaction with the program and their environmental knowledge at the end of the program. All students enjoyed seeing live animals and many asked if they could bring their own pet to show and discuss. When the survey was finished, in both schools, and the students learned that the Discovery Club was over, they asked the researcher to continue and do more programs. As Ballntyne, Fien and Packer (2001) found, just because a student liked the program does not make them more environmentally aware.

For the program group, differences between the pre- and post-program attitude and behavior scores were examined in several ways. First, differences were calculated between the pre- and post-test composite score means over all attitude and behavior items, and then differences were calculated between the pre- and post-test composite score means separately for all attitude items and all behavior domain items. Next, differences were calculated between pre- and post-test composite attitude and behavior score means for each of the eight program subject areas, and finally, the same

calculations were made controlling for who had actually attended on the day each subject area was presented.

Differences between the pre- and post-test program group score means were significant for all attitude and behavior items combined (Table 1). Thus, data for the program appeared to have a general impact when all subject areas were combined.

When separate means were calculated for attitudes and behavior over all subject areas, the attitude scores increased over the program, but the means were not significantly different. However, there was a significant positive difference in the total behavior mean scores over the program. This outcome is curious since the model used for this study suggests that attitude changes precede behavior changes. It could be that students already had positive attitudes about the environment, but lacked knowledge about how to put these attitudes into practice. Therefore, when they were provided with lessons their knowledge increased and their behavioral intentions increased. Attitude is also difficult to measure because it is made up of cognitive, affective and behavioral components (J. Petrick, personal communication, February 23, 2004). Affective attitude or emotion is the most difficult to measure and the results may indicate this difficulty. Many of the attitudinal questions on the survey were either affective or emotional. In any case, significant results for behavioral intentions indicated that students learned proper ways to recycle, conserve water, and respect wildlife.

The fact that the behavior mean increased significantly but the attitude mean did not might be due to the impact of social norms on an individual's behavioral intentions. The students might have had a weak or negative attitude about the environment, yet their

behavior might be positive due the impact of society's opinions or expectations on their behavior. Thus, attitudes and behavioral intentions might conflict, but social norms provide the basis for behaviors that are undertaken.

When means were calculated over all attitude and behavior items for each of the eight subject areas, there were positive significant changes in the means for water, birds and habitat. Water and birds had two of the lower pre-test means, but two of the higher post-mean scores. The significant change in these mean scores as opposed to the other subjects could be due to the students having less interest in the subject areas where mean changes did not occur or the students already having some knowledge and a strong interest in these subject areas before the program began. Student comments indicated that they enjoyed the habitat lesson the most. They also enjoyed participating in the bird and water lessons. Interestingly, students at program school B initially thought they were repeating a water experiment that had been done in school the previous day. After the water lesson was completed in the Discovery Club, the students stated they had fun participating and the researcher concluded that the students understood ways that water is being polluted and what they could do to conserve water.

The pre-program mean for the habitat area was one of the highest and this area showed the largest difference between the pre- and post-test mean scores. While the students already knew something about the importance of habitat, the card game played in the lesson seemed to get them even more interested. When questioned about their favorite component of the Discovery Club, four out of the six students interviewed mentioned the card game and in the comments section of the survey, six students

mentioned the card game as something they liked best about the program. Identifying activities that have the capacity to interest and hold the attention of the students is critical to increasing the impact of program participation.

When actual session attendance was controlled in the analyses, mean differences were only significant for one subject area, habitat, with mean differences for the water and bird areas almost significant. One problem in these analyses was that when data were analyzed counting only the children who actually attended a given program, sample sizes were considerably reduced. When data only for students attending a particular session were analyzed, five out of the eight pre-mean scores were lower than when all enrolled students were included. These results are counterintuitive. We would expect means to increase more between the pre- and post-tests when only students participating in the program were included. Students who attended these lessons might have chosen to come because they did not know much about the subject and they were interested in learning about it. On the other hand, students who did know about a given subject or were apprehensive about the subject might not have attended. However, there is no direct evidence from this study that would provide a definitive understanding of why these differences occurred.

The fish item mean scores for the attendees had a positive shift, but the change was not significant. Students were not as excited about the topic as they were when other animals/wildlife were talked about. A negative shift occurred in the means for the reptiles/amphibians lesson. The students said they had fun on the reptile / amphibian day. Maybe the lesson was fun but did not include significant new information. Due to

the low number of attendees, outliers could have had more impact on the means. There also was a negatively worded question about amphibians and reptiles, and with a small sample, it is difficult to determine whether the questions were misread or answered correctly. In addition, the method of surveying students at one program school was altered after there was some confusion about the directions given to students at the other school. The responses from the first school, if problematic, would also have had an effect on the means.

One possible explanation for the discrepancy between the overall attitude and behavior score mean results and the results for the individual lessons is that even though students were absent on certain days, scores were still impacted through a halo effect. Thus, the total means were impacted even when the results for the individual lesson means were not.

Differences between the program and control group mean attitude and behavior mean scores were also examined. Analyses were similar to those undertaken to determine differences between the pre- and post-test program group mean scores. First, differences were calculated between the program and control composite score over all attitude and behavior items, and then differences were calculated between the program and control composite mean scores separately for all attitude and all behavior domain items. Next, differences were calculated between program and control composite mean attitude and behavior scores for each of the eight program subject areas, and finally calculations were made to test differences in the composite knowledge scores.

None of the mean scores comparing the program and control groups were significant. The control group's composite total attitude and behavioral mean score, attitude, behavior and individual subject mean scores, except for fish, were higher than the mean scores of the pre-test from the program group. If all the students entered third grade at similar environmental levels, even though the control group did not participate in the program, their means still increased compared to the program group pre-test means. Teacher interviews showed that none of the control group students received environmental-specific programs in the fall. Even if the students received environmental programs in previous school years, comparisons of program and control group scores were made during the fall semester of third grade. Third grade is a year where students change tremendously. Some students may be influenced about the environment from someone outside of school. These students might transfer these environmental attitudes and behaviors to their peers in school. Also, after attending third grade for a semester, students might be more knowledgeable and therefore able to make important decisions concerning environmental stewardship.

Another possibility for the higher control groups mean is that response bias might have occurred. The students might have provided the answer they thought were most "correct" or desirable even if they did not believe it.

The mean scores for insects, mammals, reptiles/amphibians and attitude response were higher for the control group than the program group. Again, response bias may have played a role in the students' answers. Although gender was not recorded for the control group, the researcher noticed more males took the survey; fifteen of twenty-five

students in the program group were females. The negative shift in means (from control to program groups) for insects and reptiles/amphibians might be a gender bias in that females tend to show more fear and dislike towards these animal groups. Another possibility is that students in the control group liked insects, amphibians and reptiles more than the students in the program group.

Comparison of the knowledge scores, although not significant, did show the program group had a higher total knowledge score. Knowledge questions were based on what was taught during the Discovery Club, and those students who did not participate in programs would not have had the opportunity to increase their knowledge base. However, the control group did answer many questions correctly. Possible reasons for this occurring might be that the students knew the answers already, some of the choices were too easy, making the correct answer obvious, or the control group was good at guessing.

Correlations were made between knowledge, attitude and behavior mean scores. Both the program and control groups' attitude and behavior scores were significantly correlated. As attitude about a subject became more positive, the intention for a behavior related to that attitude also increased. Neither the correlation between behavior and knowledge nor attitude and knowledge were significant. Attitude and knowledge were close to being significant and increasing the sample size might have affected the results. If knowledge and attitudes were significant, that would link knowledge to attitude and attitude to behavior, as proposed in the Theory of Reasoned Action used in this study.

**Study Limitations**

The design and execution of the study had several limitations. The main limitation was its small sample size. Twenty-five students were in the program group and 30 students in the control group, but the number of cases available for the actual analyses was somewhat lower. The small sample size made it difficult to obtain statistically significant results.

Full participation of all program group students in the program was also problematic. Some students were absent for one or more of the program days, while, on several occasions, students were picked up before the end of the program and therefore did not attend the entire program session on that day. For one or both of these reasons, some students did not receive all or selected portions of the information for a given program day.

Since retrospective pre-post procedures were used to collect data, both pre-test and post-test data were collected at the end of the program. However, one limitation of this technique is that students may not be able to remember their knowledge, attitudes, or behavior when they started the program. In addition, at the end of the program, students might not remember information from the early program sessions. In addition, some students may have dropped out of the program and no survey could be administered.

Another limitation to obtaining reliable and valid results was developing, explaining and administering the survey in a way that was understandable for third graders. Due to problems that arose when the survey was administered to the program group at one of the schools, slight adjustments were made before giving the survey to the

program group at the other school. In addition, the pre-post was only administered to the program group while the control group answered only the post portion. If the control group had also answered the pre-portion of the survey, it would have been possible to determine if they had any changes in attitude and behavior over the semester.

To minimize variations in the way the program was presented, the same leader presented the program at each school. While the presenter had experience in developing and presenting environmental education programs, no procedures were used to determine whether the leader adhered to the stated curriculum. The study procedures did not allow determination of the impact of the program if another leader had presented it.

Information about student background characteristics was not collected during this study (an oversight). Future studies should include information about sex, ethnicity, and parental characteristics.

Despite these problems and limitations, data analyses suggested some useful findings. Strengthening the curriculum and methods of program delivery for use in future studies will help to sharpen our understanding of the impact of this type of environmental education program on the knowledge, attitudes and behavioral intentions of program participants.

Many confounding factors affected the study. Kid's Klub is an enrichment program where students play games, do homework, watch movies and do crafts. The Discovery Club might have been something to attract the students' attention because it was different from the other activities in which students were participating. The researcher could have been a confounding factor. Anyone who is excited about the

environment might be able to produce the same if not better results. By visiting the schools only once a week, it took a few weeks for the students to adjust to the styles of the researcher and by then the program was half way over.

Other factors included the selection of sites. Unintentionally, the two program schools were in more upper class neighborhoods and consisted of mostly Caucasian students, while two of the control groups were in middle class neighborhoods and had a mix of Caucasian, Hispanic and African-Americans. Ethnicity of participants was not collected in this study to compare the five schools.

**Program Implementation**

The lessons were chosen to determine if Project Wild would work in an after school setting. Looking at the data, interviews and the researcher's notes, the results were a positive indication that Project Wild was a good choice as the foundation for the developed lessons plans. These activities were hands-on ways of getting students to participate. In an after school program the environmental education program must be interesting and exciting. If another program leader used the same lesson plans in a similar after school setting, it is hoped they would receive the same, if not better results.

The results of this study cannot be generalized across all third graders. If this type of program continues to be offered in an after-school program, only those students who attend the after-school program would have the opportunity to participate. If students have adult mentors who are excited about protecting the environment, they are more likely to feel the same way as they grow older.

Further research needs to be conducted on the ability of an after-school environmental education program to influence student's attitudes and behaviors towards the environment. Also, this study might not be as effective in areas where it is difficult to obtain live species to use as examples. Recommendations were given below for future studies. Hopefully these recommendations will help create a more reliable and valid study.

**Future Study**

Based on what was learned from using the survey and curriculum, several suggestions for future studies were made. The design must be strengthened to control for the confounding factors.

A future study should be longer to obtain a larger sample. The study can not be done in both spring and fall semesters because some elementary schools begin environmental lessons in the spring. Also, those students would have a better knowledge base solely from being older and more mature. In order to compensate for this and catch the third graders all at the same point in life, the study should be conducted over two to three years. Also program groups should alternate between schools. For instance year one program group would be at Schools A & B and year two would be at schools C, D & E. By doing this, comparisons could also be made by individual school.

Another way to increase the sample size would be to use all five Kid's Klub schools as the program sample and third grade students who do not attend either Kid's Klub or Discovery Club as the control group. The school district and the principals at

the elementary schools were willing to participate in the study and would most likely let students who do not attend Kid's Klub fill out a survey.

Obtaining parental consent was the most difficult aspect of the study. If the Discovery Club is continued as part of Kid's Klub, it should gain a positive reputation and thus students might be more likely to convince parents to give consent for their children to participate. Neither talking to parents individually nor passing out the consent forms to students were effective ways of obtaining a high response rate. Due to safety and security concerns, Kid's Klub organizers would not consent to giving out parents' phone numbers, thus eliminating the possibility of personally contacting parents if they did not return the consent form.

One possible way to improve parental consent would be to have the parents sign their students up for the Discovery Club when they register for Kid's Klub in the fall. This would require the agreement of the Kid's Klub program director, to include the Discovery Club consent forms in the registration packet.

Another issue was increasing attendance of third graders in the program. Getting the Kid's Klub staff to encourage student attendance in the program would help increase student involvement. Another possibility is to offer an exciting and enticing activity the first day of the program, for example the presentation of animals that children could see and touch. Other examples of program days that helped capture student's attention and increase the likelihood of their attending the following week were the habitat/ food chain card game, reptile/ amphibian day, and mammal day. Although the reptile and mammal days did capture the subject's attention, changes need to be made so the curriculum

better impacts their attitudes and behavior. Program days, such as water, fish, and insects that were not as exciting, because live animals were not brought, could be alternated between the other programs.

Another issue that should be addressed in future studies was the length of the survey administered at the end of the program. The students complained about its length, and in a few cases, it was clear that students did not fully understand the retrospective pre-post survey format. The students in school A that were separated after each section had an easier time filling out the survey. A suggestion would be to color-code each section so the students are more likely to know they are different. Efforts should be made to see whether pre-post or retrospective pre-post are better. Overall positive attitudes towards the environment were shown with total attitude scale; however individual attitudes for each subject were not measured in this study. It would be interesting, with a larger sample, to measure individual student attitudes.

The Theory of Reasoned Action states that societal norms have an influence on behavioral intentions. Societal norms were not measured in the current study but future studies should include questions about societal norms and there should be behavioral questions reflecting students' attitude about these norms. For instance, does society think you should not touch a squirrel? Would you not touch the squirrel because society says not to? These questions may be difficult for a third grader, but it is the only way to measure whether their behavior is based on societal pressure and/or internal attitude.

The survey also should include more questions that are negatively worded. Including these questions would increase the trustworthiness of the data and provide a

means for assessing when students were not reading each of the items of the survey, and were simply responding using what they believed to be the most favorable response category, i.e., strong agree. Questions such as “I would try to help animals that are injured” were leading questions and they need to be re-written. In addition, the knowledge questions should be more difficult. For example, the question asking what four things an animal needs to survive is too obvious because the alternative answer was chocolate. The students laughed when they read the answers to the question since they obviously knew that wildlife does not eat chocolate. One way to reword the question would be “Four things animals need to survive are food, water, shelter and (a) space (b) trees (c) chocolate (d) Sun.”

More than three students from all five schools should be interviewed and interviews should also be conducted with their parents. If possible, these interviews should be recorded to. The interviews would help better understand how environmental knowledge, attitudes and behavior had been influenced by school or parental influences, in addition to influences that could be attributed to participation in the program. The questions should focus on how students obtain their environmental knowledge. Previous questions asked in the interview (Did you like the discovery club?, What was your favorite or least favorite part?, Would you change anything?, Did you learn anything form coming?, Have you learned anything like this in school?, Do you recycle at home?, school?) were good yet more questions about parents and previous grades in school should also be included. For example, “Do you spend time outdoors with your parents?, Do you go to local parks, state parks, or national parks with your parents?, What do your

parents tell you about wild animals in the area?, Do you participate in programs such as boy scouts/ girl scouts/ Indian princesses?, Have you learned about the environment from any other places?, Did you talk about any aspect of the environment in first or second grade?." Teacher interviews should also be more in depth, maybe meeting the third grade staff together before or after school or during a joint conference time. Also it would be a good idea to interview second grade teachers and find out what, if any, lessons they conduct on the environment.

**Final Thoughts**

The Discovery Club program was developed to impact third graders knowledge, attitudes and behavior about the environment. This study provided a first step to creating reliable and valid data on the impact of this type of program when it is included as one part of after school programs. As demonstrated by this study, an after school setting can be a difficult yet rewarding venue for presenting an environmental education program. However, through these types of program, there is the possibility of creating young stewards of the environment who will continue to make environmentally sound decisions throughout their lives. If taught early, it is hoped that as these children grow into adults, they will value the environment and will help protect it. In the words of Baba Dioum "in the end we will conserve only what we love. We love only what we understand. We will understand only what we are taught" (Dioum, n.d., p. 1).

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# APPENDIX A

# CONSENT AND ASSENT FORMS

**Parent Consent Form**
**Discovery Club, Kids Klub Project**

I understand that Carin Vadala, a Recreation, Park and Tourism Science graduate student at Texas A&M, is offering a program called Discovery Club for 50 third graders at the Kids Klub, and the program offers children an opportunity to learn more about the environment. I understand that under guidance from Carin and other Texas A&M students, my child will be participating every week for the 2003 Fall semester in hands on activities about topics such as water, air, land, mammals, birds, and fish etc. I understand that Carin will be administering short surveys to the children to determine changes in knowledge, attitudes or behaviors as a result of participating in the Discovery Club program. I understand that copies of surveys are available on request. The program is being offered to about fifty third graders at Pebble Creek, Southwood Valley, College Hills, South Knoll and Rock Prairie Elementary schools. Peter A. Witt, professor in Department of Recreation, Park & Tourism Sciences, is her advisor for this project.

I understand that the program is designed specifically for the benefit of those involved; however, it is also part of a research project Carin is conducting. As a result of the project she hopes that participants will 1) increase their knowledge of air, water, land, and recycling, including but not limited to, the ozone, clouds, rain, snow, fresh & salt water, desert, mountainous terrain and recycling and reusing materials; 2) be able to describe the distinguishing characteristics of insects, fish, amphibians, reptiles, birds and mammals; 3) increase their knowledge about recycling and conservation practices and understand the importance of undertaking these practices and promoting conservation of land and wildlife; and 4) gain knowledge about local flora and fauna in the Bryan/ College Station area. Your child's participation in this study will help develop a program to be used by other after-school programs in the future. Results of the study will not list any child by name and all data will be anonymous.

I understand that Carin will bring live animals (e.g., hedgehogs, fish, grasshoppers, frogs, turtles, non-poisonous snakes, finches) to some sessions for viewing. I further understand that if children touch these animals they will wash their hands immediately afterwards and that no sick or injured animals will be used. Participants will only touch animals if they wish to and if the animal's owner has given permission prior to the presentation. I understand that given the nature of the animals used in the program, there should be little to no risk to my child.

I understand that this research has been reviewed and approved by the Institutional Review Board - Human Subjects in research, Texas A&M University. For research-related problems or questions regarding subjects' rights, I can contact the Institutional Review Board through Dr. Michael W. Buckley, Director of Support Services, Office of Vice President for Research at (979) 458-4067.

For further information please contact Carin: cvadala@rpts.tamu.edu or her advisor, Dr. Peter Witt: pwitt@tamu.edu

I have read and understand the explanation provided to me. I have had all my questions answered to my satisfaction, and I voluntarily agree for my child _____ to participate in this study.

I may keep page 1 of this form for my references and return page 2 in the self addressed stamped envelope.

_____ _____
Signature of Parent or Guardian Date

_____
Carin Vadala

I also understand that Carin will conduct separate interviews about the Discovery Club with three children from each school. I give permission for my child to be interviewed by Carin.

_____
Signature of Parent or Guardian

**Parent Consent Form**
**Discovery Club, Kids Klub Project**

I understand that Carin Vadala, a Recreation, Park and Tourism Science graduate student at Texas A&M, is offering a program called Discovery Club for 50 third graders at the Kids Klub, and the program offers children an opportunity to learn more about the environment. I understand that under guidance from Carin and other Texas A&M students, my child will be participating every week for the 2004 Spring semester in hands on activities about topics such as water, air, land, mammals, birds, and fish etc. I understand that Carin will be administering short surveys to the children this December, before the program begins in the spring. The surveys will help Carin determine knowledge, attitudes or behaviors the children have about the environment. I understand that copies of surveys are available on request. The program is being offered to about fifty third graders at Pebble Creek, Southwood Valley, College Hills, South Knoll and Rock Prairie Elementary schools. Peter A. Witt, professor in Department of Recreation, Park & Tourism Sciences, is her advisor for this project.

I understand that the program is designed specifically for the benefit of those involved; however, it is also part of a research project Carin is conducting. As a result of the project she hopes that participants will 1) increase their knowledge of air, water, land, and recycling, including but not limited to, the ozone, clouds, rain, snow, fresh & salt water, desert, mountainous terrain and recycling and reusing materials; 2) be able to describe the distinguishing characteristics of insects, fish, amphibians, reptiles, birds and mammals; 3) increase their knowledge about recycling and conservation practices and understand the importance of undertaking these practices and promoting conservation of land and wildlife; and 4) gain knowledge about local flora and fauna in the Bryan/ College Station area. Your child's participation in this study will help develop a program to be used by other after-school programs in the future. Results of the study will not list any child by name and all data will be anonymous.

I understand that Carin will bring live animals (e.g., hedgehogs, fish, grasshoppers, frogs, turtles, non-poisonous snakes, finches) to some sessions for viewing. I further understand that if children touch these animals they will wash their hands immediately afterwards and that no sick or injured animals will be used. Participants will only touch animals if they wish to and if the animal's owner has given permission prior to the presentation. I understand that given the nature of the animals used in the program, there should be little to no risk to my child.

I understand that this research has been reviewed and approved by the Institutional Review Board - Human Subjects in research, Texas A&M University. For research-related problems or questions regarding subjects' rights, I can contact the Institutional Review Board through Dr. Michael W. Buckley, Director of Support Services, Office of Vice President for Research at (979) 458-4067.

For further information please contact Carin: cvadala@rpts.tamu.edu or her advisor, Dr. Peter Witt: pwitt@tamu.edu

I have read and understand the explanation provided to me. I have had all my questions answered to my satisfaction, and I voluntarily agree for my child _____ to participate in this study.

I may keep page 1 of this form for my references and return page 2 in the self addressed stamped envelope.

_____ _____
Signature of Parent or Guardian Date

_____
Carin Vadala

I also understand that Carin will conduct separate interviews about the Discovery Club with three children from each school. I give permission for my child to be interviewed by Carin.

_____
Signature of Parent or Guardian

**Student Consent Form**
**Discovery Club, Kids Klub Project**

I understand that Kid's Klub is offering a program called Discovery Club for third graders like myself. I also understand that Carin Vadala, a graduate student at Texas A&M, created the Discovery Club so I can learn more about water, plants, and animals. I understand that Carin and other A&M students will come every week to do activities with me about topics such as water, air, land, mammals, birds, and fish. I also understand that at the end of the Discovery Club, I will be asked to fill out a short survey to see what I have learned by participating in the activities.

I understand that several live animals (such as hedgehogs, fish, grasshoppers, frogs, turtles, non-poisonous snakes, finches) will be brought to some sessions for me to see and that sometimes I will be allowed to touch the animals. However, understand that I do not have to touch any of the animals unless I want to. If I am allowed to touch any of the animals, I understand that I will be asked to wash my hands immediately afterwards.

I understand that my participation in this project will help develop a program that can be used in other after-school programs in the future and that my name will remain anonymous.

I understand that this research has been reviewed and approved by the Institutional Review Board - Human Subjects in research, Texas A&M University. For research-related problems or questions regarding subjects' rights, I can contact the Institutional Review Board through Dr. Michael W. Buckley, Director of Support Services, Office of Vice President for Research at (979) 458-4067.

I have read and understand the explanation provided to me. I have had all my questions answered to my satisfaction, and I voluntarily agree to participate in this study.

I have been given a copy of this consent form.

_____
Printed Name

_____ _____
Signature Date

_____
Carin Vadala

For further information please contact Carin: cvadala@rpts.tamu.edu or her advisor, Dr. Peter Witt: pwitt@tamu.edu

# APPENDIX B

# LESSON PLANS

# Recycling

**Background Knowledge**

Know where in the city students can take items to be recycled, or if the city picks up recyclables during the trash pick-up. Make a list of items students might use on a daily basis (might differ by the age of the student).

**Objectives**

Students will know the difference in recycling and reusing. The students will know how/where to recycle items in their home town. They will be able to recognize items that can be recycled or reused.

**Materials**

10 Copies of each Habitrekkeing evidence cards
Small milk cartons, enough for one per child
Hole punch
Scissors
Stapler
String/ twine
Bird seed
Ziploc plastic bags
Assortment of trash (some recyclable and some not)

**Preparation**

Before going to the site, pre-fill the Ziploc plastic bags with birdseed. Cut the string/twine into strips about a foot long. After arriving, establish the study sites where the students will be looking for evidence. School grounds, urban city centers, forested parks, vacant lots, etc., can be used as study sites. Place the trash on the field where the students will go habitrekking. Put some in the trees and other places that may show evidence of harm to an animal. **Make sure the students don't see you putting the trash out.**

**Lesson Sequence**

1. Introduction
    a. Divide the group into three small groups. Have the students in each group pair off.
    b. Provide Habitrekking Evidence Lists for each pair in the group.

   c. Before starting, ask a student from each group to read his or her Habitrekking Evidence List to make sure each member understands what they are looking for. Make sure the students have a clear definition of wildlife and habitat. Establish a length of time for the investigations. Thirty minutes is recommended if the students stay near the school or organization where this activity began. Tell the students they should exercise their creativity because there is no right or wrong answers. They may observe and infer. Both are sources of evidence.

2. Activity 1
   a. Send the students "habitrekking." Assist students with finding evidence.
3. Activity 2
   a. When they return, ask each pair to present its evidence, including both pictures and words. The pairs within each group can compare their findings as they prepare for their group's report.
   b. In the discussion, ask the students to summarize what they learned. Emphasize the generalizations that people and wildlife have similar basic needs, share environments and are subject to the same or similar environmental problems. Bring in the words recycling and reusing to the discussion. Discuss the definitions and ask the students if any of the items they picked up could either be recycled or reused. Tell the students they are going to be able to reuse an item to make birdfeeders.
4. Activity 3
   a. Show the students the milk cartons. Demonstrate how the birdfeeders will be made. Take the scissors and cut a door on one side of the carton. Only cut a top and two sides so the door folds down and can be used as a perch for the bird. **Do not cut the door all the way to the bottom of the carton because if the wind blows all the seed will fall out.**
   b. Punch two holes at the top of the carton so that if it was closed, the string can be stuck through it. Tie a knot at the tops of the string to make a large enough loop for it to fit on a tree branch. Take the stapler and staple the top closed. Hand out the bags of birdseed at the end and tell the students not to open it or put the birdseed in it until they hang their birdfeeder up.

**GROUP #1**
**HABITREKKING EVIDENCE LIST #1**

**Caution:** You may bring back evidence, but be careful not to harm the wildlife or environment

**Find Evidence That:**

1. Humans, domesticated animals and wildlife all need food, water, shelter and space arranged so they can survive.
2. All living things are affected by their environment.
3. Animals-including people-depend on plants-either directly or indirectly.

**GROUP #2**
**HABITREKKING EVIDENCE LIST #2**

**Caution:** You may bring back evidence, but be careful not to harm the wildlife or environment

**Find Evidence That:**

1. Humans and wildlife share environments.
2. Wildlife is everywhere.
3. Wildlife can be in many forms and colors, and can have special features that help it live in its environment.

**GROUP #3**
**HABITREKKING EVIDENCE LIST #3**

**Caution:** You may bring back evidence, but be careful not to harm the wildlife or environment

**Find Evidence That:**

1. Humans and wildlife are subject to the same or similar environmental problems.
2. The health and well-being of both people and wildlife is dependent upon a good environment.
3. Environmental pollution affects people, domesticated animals and wildlife.

5. Closure
   a. Tie recycling and reusing together with the impacts on humans and wildlife

Habitrekking taken from Lessons in Project Wild book. Council for Environmental Education. (1999). Project Wild & Aquatic Wild. Project Wild Publishers.

# Water

**Background Knowledge:**

The Earth has three different available water sources. One source is useable fresh water which is suitable for drinking, hygiene, and home use, as well as plant and animal use. This water comes from reservoirs, streams, lakes, or underground water sources and is only one percent of the Earth's water. Another source is frozen, non-available, fresh water found in the polar caps and glaciers. This frozen water source is two percent of the Earth's water. The third source is salt water found in oceans, seas, and lakes and constitutes the majority, or 97, of the Earth's water. Salt water is not suitable for culinary, plant, or animal purposes.

Students need water education and facts regarding the limited supply of useable water. When students become aware that water is a precious commodity and there is not an endless supply, hopefully, they will not waste it. If first-grade students become aware of the need for using water while they are young, they will be more apt to use it sparingly and wisely as they mature. Thus, they may positively affect the future water supply by influencing family members and their societies to be more responsible water users.

**Objectives**

Students will investigate water and how it is used. They will understand that there is only a finite amount of water. They will know ways to conserve water in their daily lives.

**Materials**

Large aquarium
Plastic trash can
Small bucket
Vegetable oil
Food coloring
Eye droplet
4-5 large sponges
Paper towels
Table to set the aquarium and bowls on
Dry erase marker
Soft globe ball (beach ball)
Clear plastic cups (2 for the first activity and enough for each child to have one)
1-cup measuring cup
1/2-cup measuring cup
3 index cards cut out to look like water drops.
Source for water

**Preparation**

Fill the trash can about half full with water (enough so that the students can get 50 cups from it). Place the aquarium on the table, keeping the trash can on the ground. Label the water drops 1, 2 & 3. On the opposite side of the numbers write on the first water drop (index card) that 50 cups of water equals all the water in the world. On the second, 1 cup of water equals all the water frozen in ice. On the third, ½ cup of water equals all the water in rivers and lakes. Consider laminating the drops. Place them upside down on the table behind the aquarium.

**Lesson Sequence**

1) Introduction
    a. To introduce the lesson, have the students work in pairs to think of ways they use water. Each student pair will select one of their water uses and charade while the rest of the class guesses what water usage they are dramatizing.
2) Activity 1

a. Have students join hands to make a circle around the desk with the tub. Tell them they represent the world's water bodies and the tub is a reservoir which will hold the water they put into it. One student at a time will march to the water source, fill the 1-cup measuring cup and dump it into the tub. Students will count as the cups of water are tallied on the board. Continue until 50 cups have been dumped into the reservoir.
b. Have the students sit down in a circle. Choose "Miss or Mr. Ocean" to pull out the 1st paper water drop from underneath the water tub. Have the student read the message. Ask, "What does this statement mean?" Allow student responses. Refer to the globe again, have students point to the water sources and explain that the 50 cups they just dumped into the reservoir represents all the water in the world and most of it is salty ocean water.
c. Have a second and third student pretend they are Mr. Arctic and Miss Antarctica. Have the two students each take 1/2 cup water from the "reservoir" and dump it into one plastic cup. Have Mr. Arctic pull out water drop 2 and have the Miss Antarctica read it. Ask students if they know what it means. Explain that 1 cup represents the amount of water in the Polar Regions. Students should realize if it is frozen, it can't be used.
d. Pick a student to find the last water drop. This person represents the fresh water source and could be referred to Mr./Miss Lake. Have the student read the message and pour 1/2 cup of water into the second plastic cup. Ask students if they think 1/2 cup of water is enough for all the people, animals, and plants to use in the world. Discuss and guide students to realize that water is a precious resource we need to conserve.

3) Activity 2
   a. Dump the two cups of water back in the aquarium.
   b. Have a student take a dry erase marker and trace the line of water across the aquarium.
   c. Ask the students if they can think of ways they waste water in their daily lives. Help prompt them if they can not think of any. Every time a student comes up with a new way have them take a sponge and dip in the aquarium and squeeze it in the small bucket placed on the side.
   d. After students can no longer think of ways to waste water, ask them to think of ways to conserve the same water they just talked about wasting. Have them come and dip the sponge in the small bucket and put the water back into the aquarium. Keep going until the students have no more ideas; it is ok to prompt them. **Try not to let the water level reach the previous line drawn.** After it is done have one student take the dry erase marker and draw a line where the water is now.
   e. Discuss reasons why the water level is not the same as when they started. There is always some water lost in the system, but if we conserve what we have it will last longer.
4) Activity 3

a. Have the student each get a plastic cup and fill it up with water from the trash can on the ground. Ask students to think of ways water could be polluted. Once again it is ok to prompt them for answers. If they talk about oil, have them use the eye dropper to place a few drops of oil in their cup. For all other pollution answers have the students choose a food coloring and put a couple drops in their cups.
b. Ask the students to predict that if they dumped their water on one side of the aquarium, how long/ many cups it would take to spread across all the water. Discuss how difficult it would be to clean the water, make it safe to drink, and also how expensive that would be.

5) Closure
    a. Tie the concepts together and challenge students to begin conserving water at home.

# Fish

**Background Knowledge**

Fish, like all animals, have special adaptations to help them survive. Torpedo shape fish are able to swim at high speeds, flat bellied fish feed at the bottom of the ocean, horizontal disc shaped fish live at the bottom of the ocean and tend to blend into the ocean floor, vertical disc shaped fish feeds above or below themselves and hump backed fish are able to stabilize themselves in the water and swim at high rates of speed. The uses of mouths vary depending on where the fish lives in the ocean. A sucker shaped mouth is used for feeding on the ocean floor, extremely large jaws allows the fish to open it's mouth and feed on large prey, duckbill jaws help in grasping prey, elongate upper jaw aids the fish in feeding on prey below it and elongate lower jaw aids in feeding on prey above it. Coloration is also an indicator of where a fish lives in the ocean. Vertical and horizontal stripes help a fish to camouflage in vegetation while mottled coloration is used for camouflage in rocks or at the ocean floor. A fish with a light colored belly would swim closer towards the surface because it helps the fish to blend in with the sunlight if a predator were to swim underneath it. A fish with a dark upper-side would live near the bottom so, if a predator swam above, it would blend in with the darkness below. Different modes of reproduction help with the success rate of the young living to adulthood. Some fish are more involved as "parents" than other fish. A fish that lays eggs in the open ocean does not have to help rear the fish. The eggs float until they hatch and the fish swim away. Fish that lay their eggs on the ocean floor have a larger survival rate than the open water because all the eggs are together and they might blend into the bottom. Fish that lay eggs in the nest have an even better survival rate of them hatching because they take care of the fish. Other fish lay their eggs in vegetation so they are protected and finally, some fish have live birth which ultimately increases the survival because it eliminates the egg stage.

**Objective**

Students will know what the word adaptation means. They will understand how fish have special adaptations to survive.

**Materials**

White sheets of paper
20 index cards
Markers or crayons

**Preparation**

Separate the index cards into four groups of five cards. Using a separate color marker for each group, write mouth on the first set, body shape on the second, reproduction on the third, and coloration on the fourth. On the opposite side of the mouth cards write one of the following adaptations; sucker shaped mouth, elongate upper jaw, elongate lower jaw, extremely large jaws, and duckbill jaws. On one of each of the body shape cards write torpedo shape, flat bellied, hump backed, horizontal disc, vertical disc. On one of each of the reproduction cards write floating eggs, eggs deposited on ocean floor, eggs deposited in nest, eggs deposited in vegetation and live bearers. On one of each of the coloration cards write mottled coloration, lightly colored underside, dark upper side, vertical stripes and horizontal stripes. Research types of fish that have these kinds of adaptations. Find pictures of fish that demonstrated these adaptations.

**Lesson Sequence**

1) Introduction of topic to class
    a. Briefly introduce the word adaptations and how animals benefit from having specific adaptations. Give examples, such as humans can run fast on two legs, animals that graze on grass have eyes on the side of their head and can see all around them.
2) Activity 1
3) Activity 2 Based from Fish Adaptations from Project Wild (1999)
    a. Separate the class into five equal groups and pass out paper to each student and markers or crayons to the groups.
    b. Have each group blindly choose one card from each of the four categories of reproduction, coloration, mouth and body shape
    c. Tell students to draw a fish based on the adaptations their group chose. When finished drawing the fish, name it.
    d. Share the new fish with the class and discuss each of the adaptations and how they benefit each fish.
    e. Give examples of fish that actually have these adaptations and if possible show the pictures of these fish

4) Closure
    a. Review how adaptations benefit animals and how each animal has their own adaptation to help them survive

Fish Adaptations taken from lessons in Project Wild. Council for Environmental Education. (1999). Project Wild & Aquatic Wild. Project Wild Publishers.

# Insects

**Background Knowledge**

Insects have the most number of species (1,000,000) compared to any other animal group. They have three body parts, head, abdomen and thorax. They have six legs that are all attached to the abdomen and two antennae. Insects use many types of locomotion including walking, jumping and flying.

**Objectives**

Students will learn the difference between good bugs and bad bugs. They will know about the different types of locomotion insects have.

**Materials**

One cricket for every two students (unless it's a nice day and they can go out and catch their own)
One magnifying glass for every two students
Box of preserved insects
Milk cartons for insect catching
Nets for students to catch insects (open nets for butterflies, nets made from canvas for sweeping and a square piece of canvas mounted on wood in shape of a square)

**Preparation**

Borrow preserved insects from Texas A&M Entomology Department. Make the canvas nets and canvas square if it can't be found in stores.

**Lesson sequence**

1) Introduction of topic to class
    a. Introduce insects
    b. They have the most amount of species compared to any other animal group

   c. There are good bugs (ladybugs, butterflies, mosquito hawks, bees for honey and beeswax) and bad bugs (mosquitoes, grasshoppers, flies, wasps for stinging)
2) Activity 2 Ultimate Being (K. Haras, Personal Communication, September 20, 2003)
   a. Tell students the life cycle of the salmon (egg, fry, alevin, adult)
   b. Show the students the stages (egg is squatting with hands around legs, fry is squatting with hands out, alevin is squatting with hands on mouth as a fish, and adult is standing with hands on mouth)
   c. Students play paper, rock, scissors with each other (only play someone who is in the same lifecycle, e.g. fry plays fry and eggs play eggs).
   d. If you win you move onto the next stage and play someone at that lifecycle
   e. If you lose at the fry, alevin or adult lifecycle then you go back to the one previous
   f. Let the students play for about 10 minutes and then stop them, count how many students ended in each lifecycle
   g. Salmon eggs are laid in the river, hatch, swim out to sea and then return some 5-10 years later to the same spot to spawn (lay eggs)
   h. Stress that this kind of situation happens in real life, of the 5000 salmon eggs that are laid, only 2 adults will return to spawn.
   i. Why does that happen? Predators, bears, whales, humans all impact the salmon population.
3) Activity 3 Based from Insect Gravity in Project Wild (1999)
   a. Give all the students small milk cartons, emphasize they are reusing a household good, and go out with students and help them catch insects
   b. Show them how to use the sweep net ( In very fast motions sweeping back and forth on the ground as you walk)
   c. Show them how to use the square net to catch insects from trees and bushes (Place the square underneath a branch and shake the branch, the square will catch everything underneath)
   d. Give them 15 minutes or so of catching insects
   e. Pass out magnifying glasses and have them study the insects
   f. **Activity 1 alternative in case of bad weather**
   g. Give every two students a cricket (can get at pet store) and a magnifying glass
      i. Ask the students to be careful with the crickets because we will set them free when we are done
   h. While they are examining it prompt them with questions like
      i. What are coming out from his head?
      ii. How many body sections do insects have?
      iii. Are insect's vertebrates or invertebrates?
      iv. What kind of locomotion does the cricket have?
      v. What adaptations of the legs help with this locomotion?

i. Let all the insects/crickets go outside

4) Activity 3
    a. Discuss the insects found in the local area
    b. Show students different types of preserved insects
    c. Once again show all the different locomotion types
    d. Insects are the most diverse animals in the world having over a million different kinds of species
5) Closure
    a. Talk about insects as a whole and tie lessons together.

Insect gravity taken from lessons in Project Wild. Council for Environmental Education. (1999). Project Wild & Aquatic Wild. Project Wild Publishers.

# Birds

**Background Knowledge**

Know what birds use their beaks for. Birds have other adaptations such as a four chambered heart, hollow bones, wings, beaks, air sacs and of course flying (except for the penguin, emu, ostrich and kiwi). Ducks and other water birds deflate their air sacs to submerse under water. Some ducks/water birds dive under water while others swim at the surface and dip their head in.

**Objectives**

Students will know what a bird eats based on what the beak looks like. They will understand what adaptations help and bird fly and what birds don't fly.

**Materials**

Small tree or log
Rice
Aquarium half full with water
Popcorn
White paper
Whole Pecans
2 vases with small openings filled with water
Sand pail
Raisins
Ice cube holder (box)
Oatmeal
Gummy worms
Plastic bowl filled with water

Styrofoam balls different sizes
Piece of poster board with staples all over the edges
Marshmallows on a sheet of paper
2-3 Envelopes
2-3 Tweezers
2-3 Strainers
2-3 Nut crackers
2-3 Eye droppers
2-3 Tongs
2-3 sets of Chop sticks
2-3 Slotted spoons
2-3 Staple removers
Preserved birds with beaks like ones being modeled
Bowls to set aside the experiment to put food caught

**Preparation**

Make enough copies of the beaks for all the students in the class. Print out on sheets of paper station 1, station 2… up to station 9. Set up all stations on a long table (might have to use both sides of a table or two tables).

a. log with rice on it & tweezers
b. aquarium with water and popcorn in it & strainer
c. white paper with pecans on it & nut cracker
d. vases filled with water & eye dropper
e. sand pail filled with water and raisins dropped in & tongs
f. ice cube box with worms in it covered by oatmeal & chop sticks
g. plastic bowl with water and Styrofoam balls in it & slotted spoon
h. poster board with staples in it & staple remover
i. marshmallows on sheet of paper and envelope

After placing the correct tool on the table place two alternate tools to test. For example, tweezers are the correct tool for station 1; add an eye dropper and a slotted spoon. Do this for all nine of the stations. Pick up preserved birds from Texas Cooperative Wildlife Collections.

**Lesson Sequence**

1) Introduction of topic to class
    j. Talk about how birds also have special adaptations that help them eat
2) Activity 1 Play Water We Eating? From Project Wild (1999)
    a. Pass out paper with bird beak drawings on it
    b. Explain the project; the tools correspond to the type of beak. If it is a long tool then the bird has a long beak

c. Tell the students to rotate each of the stations and test all of the tools to figure out which one works best.
d. Then try and match that tool with the beaks to see which bird it is
e. Walk around and help the students by saying it is a long beak, a sharp beak, a tiny beak or a skimming type beak

3) Activity 2
   a. Show students preserved birds that match the beaks in the pictures. Have the students tell if they answered correctly for each beak, and talk about the differences in them
4) Closure
   a. Talk about birds other adaptations
      a) Four chambered heart
      b) Hollow bones
      c) Wings
      d) Beaks
      e) Air sacs
      f) Flying (which birds don't fly)

Water we eating? taken from lessons in Project Wild. Council for Environmental Education. (1999). Project Wild & Aquatic Wild. Project Wild Publishers.

# Reptiles

**Background Knowledge**

Study the habitats and learn which amphibian/reptile belongs where.
Amphibians/reptiles are cold blooded or ectotherms. All of their energy comes from the heat of the sun. On cold days these animals remain rocks or buried and don't move in order to conserve energy until it warms up. Alligators, crocodiles, Turtles, snakes and lizards are all reptiles. Reptiles have scales all over their bodies and they shed these scales periodically (usually once a year). The turtle's scales are on its shell. It cannot live without its shell because the backbone is also in the shell. Frogs, toads, salamanders and newts are all amphibians. They live in water during some stage of their life (e.g. Frogs begin as tadpoles, newts and salamanders live in water their entire lives). Amphibians are able to take water in through their skin. They stay moist because water can go in and out.

**Objectives**

Students will learn the differences between reptiles and amphibians. They will learn the different types of amphibians and reptiles that live in Texas. Hopefully, through the day students with fears towards the animals will learn to respect them.

**Materials**

Rope
Poster board with species list
16 Mouse traps
Lots of colored play frogs, lizards and snakes (Toys'R'us enough for the listed species)
Two sets of plastic garden tools
3 Blindfolds
Debris such as
- Tennis balls
- Plastic cups
- Swim noodles cut into small round pieces
- Other odd shaped balls

Live non-venomous reptiles and amphibians to show
An adult comfortable with handling the live animals

**Preparation**

Get live animals from volunteers. Use a marker to list all the species on a poster board.

Gulf Coast Toad-Yellow
Southern Leopard Frog-Purple
Bullfrog-Blue
Cricket Frog-Red
Gray Tree Frog-Green

Horned Lizard-Green
Green Anole-Yellow
Ground Skink-Orange
Mediterranean Gecko-Pink

Texas Rat Snake-Blue
Diamondback Water snake-Purple
Copperhead-Orange
Cotton mouth-Yellow
Diamondback rattlesnake-Pink

That way the students will have a reference of what they are looking for. Set up the mine field. Lay the rope out into a circle and place the mouse traps randomly inside the circle (don't set them for young kids). Distribute all the debris evenly throughout the minefield. Finally place the amphibians and reptiles (keep count) in hard to see places such as under debris in cups. Set the habitats randomly around the outside of the circle with cups next to them

Habitat: Coastal prairies, backyard gardens, urban/suburban sewers. (Gulf Coast Toad)

Habitat: Shallow freshwater habitat, vegetated areas (Cricket Frog, Southern Leopard frog)

Habitat: Large bodies of water, ponds, lakes and slow streams, vegetated areas (Bullfrog)

Habitat: Trees, Shrubs, Vines (Green Anole, Gray Tree Frog)

Habitat: Moist, humid & wooded environments (Ground Skink)

Habitat: In urban areas near light sources (Mediterranean Gecko)

Habitat: Grassy prairies/ Coastal Plains (Texas Rat Snake)

Habitat: River Valley and most of East Texas (Diamond back water snake)

Habitat: Living in leaf piles beneath trees, or alongside logs and stones in wooded forests (Copperhead)

Habitat: Rugged, arid, semi-desert type environment, dry, sandy or rocky terrain (Horned Lizard, Diamond Back Rattlesnake)

Habitat: Wetlands such as swamps and sloughs (Cottonmouth)

**Lesson Sequence**

1) Introduction of topic to class
2) Activity 1 (minefield) (K. Haras, Personal Communication, March 20, 2003)
    a. Challenge the kids by reading the following aloud

Your mission should you choose to accept it. Aliens have kidnapped all the amphibians and reptiles in the world. Many of the Texas species are lost in this debris field. Your job, while the aliens are sleeping, is to save these species by getting them out of the debris field and into the environment they belong. The debris field is lit by blinding lights, so you must wear protective eye cover when entering. Also, if you set off three traps the aliens will awaken and catch you. Now, some of the snakes in Texas are venomous. You must figure out a way to pick these snakes up other than using your hands. If you touch a venomous snake with your hands then you must come out of the debris field and sit out to be taken care of. If upset the horned lizard may spit blood, you can put it to sleep by laying it on its back and rubbing its belly. Once you get the species out of the debris field you have two minutes to place it in the environment it belongs otherwise it won't survive. If you put it in the wrong environment it won't survive. You

can ask us questions in trying to figure out where the animal lives, but once a spot is chosen you can't move it. You have twenty minutes to complete your mission, so keep track of your time (teacher can keep track of time if the students are young.

b. Have students help clean up before showing animals

3) Activity 2
    a. Show live animals and discuss adaptations of the animals
        i. Cold blooded/ ectotherms
    b. Talk about differences between amphibians and reptiles
    c. Talk about common fears and that reptiles and amphibians actually eat mice, rats and many of the bad insects discussed earlier.
4) Closure
    a. Review characteristics of amphibians and reptiles

# Mammals

**Background Knowledge**

Mammals have the least amount of species (4260) compared to all the other animal groups. The world's smallest mammal is the bumblebee bat, as big as a bumblebee and weighing as little as a penny. The world's largest mammal is the blue whale, at about 110 ft. long and weighing approximately 380,000 lbs. Mammals have five distinct characteristics, hair, mammary glands to suckle young, live birth, four chambered heart, and they are warm blooded. Mammals also demonstrate many types of locomotion including running, jumping, flying and swimming. Diet of a mammal can be inferred by teeth. Carnivores, which eat meat, have sharp teeth throughout with large canine incisors. Herbivores eat plants and have flat teeth that are able to grind together. Omnivores eat a combination of meat and plants and have teeth for tearing in the front and grinding in the back.

**Objectives**

Students will learn the characteristics of mammals. The will learn the world's smallest and largest mammal. They will also see the different adaptations of teeth that tell what kind of diet the mammal eats. Students will understand the concept of carrying capacity and how it effects populations of wildlife.

**Materials**

Paper
Pencil
Skulls

Pelts and preserved local fauna
Live mammals borrowed from friends
Rope

**Preparation**

Place the pelts and skulls together in a specific order (smallest to largest). Get live animals from volunteers.

**Lesson Sequence**

1) Introduction of topic to class
    a. Animals need what four things to survive? Food, water shelter and space
2) Activity 1 oh Deer from Project Wild (1999)
    a. Number the students of one to four. Ones (deer) stay on one line and face the two, threes and fours (habitat) who are about 15 ft away
    b. Demonstrate to all the students that they will either be shelter, water or food, shelter hands meet over head making an upside down v, food is hands on stomach and water is both hands on mouth. Tell students that on your cue they will turn around and pick food, water or shelter and then turn around again on cue. The deer will find a matching item and run across to get them. The deer that find a match will take them back to the deer side to become deer. If the deer doesn't find a match, they die and become part of the environment
    c. Have the students turn around and decide to be either shelter, water or food (make sure they do the hand motion)
    d. Have students turn and face each other. The deer run to find someone that has a matching symbol.
    e. If the deer caught someone with a matching symbol then that person becomes a deer and goes over to the deer side. If the deer did not catch anyone than the deer dies and becomes part of the habitat.
    f. Play the game a quick 15 or so rounds counting and writing down the number of deer each round.
    g. Each round represents a year. So year 1, 2, 3...15. Draw a graph with years on the x-axis and number of deer on the y-axis. The graph should be rolling hills.
    h. Explain that this happens in real life. There is plenty of food, water and shelter so the deer reproduce until they reach maximum capacity and then die from a lack of food, water and shelter. The deer have reached carrying capacity
3) Activity 2 Classroom Carrying Capacity from Project Wild (1999)
    a. Ask the students if they know what carrying capacity means.
    b. Have the students spread out to where they can't touch anyone, do they feel comfortable to do anything they want

   c. Then have the students step inside a circle of rope, do they feel comfortable to do anything they want
   d. Finally, close the rope in, do they feel comfortable to do anything they want
   e. That is carrying capacity
4) Activity 3
   a. Show animals one at a time by skull first to try and have the students guess the animal
   b. Talk about the five main characteristics that describe a mammal
   c. Talk about the smallest and largest mammal in the world
   d. Talk about different types of locomotion mammals have
   e. Talk about different types of diets by the shapes of the teeth
      i. Carnivore
      ii. Herbivore
      iii. Omnivore
5) Closure
   a. Sum up the characteristics of mammals and that we too are mammals

Oh Deer and Classroom Carrying Capacity taken from lessons in Project Wild. Council for Environmental Education. (1999). Project Wild & Aquatic Wild. Project Wild Publishers.

# Food Chain

**Background Knowledge**

Nature is made up of a food web. At the bottom of the food web is death and decay (which also consumes everything), then mold/ fungus, plants and bugs on up to top predators such as eagles, bears and wolves.

**Objectives**

Students will understand the components of the food web and how each part is related to each other. They will also know what animals live in which environments.

**Materials**

Into the forest, Nature's Food Chain Game (obtained from www.ampersandpress.com)

**Preparation**

Obtain the Food Chain Game and learn the rules.

**Lesson Sequence**

1) Introduction
    a. Explain the Into the Forest Game
    b. Players will be given cards and want to obtain the most energy points
    c. The first player starts by asking any other player for a showdown (In a showdown each of the two players lays down a card face up at exactly the same time. If one card eats the other then the player with that card wins both cards. If both eat each other or if neither eats each other than they keep their own cards. After a showdown the play goes to the next player
    d. The second player can then choose either a showdown with a player of choice or a challenge. In a challenge the student picks another player and asks if they have something that is eaten by one of the cards in their hand (e.g. player 2 has a bear and they pick someone and ask if they have a deer). If the person challenged does not have the card asked for than the person asking has to give up his challenging card to that person. Then the player's turn is over. If they choose challenge and win then they get another turn. The death and decay card can only be used once per turn in a challenge or showdown.
    e. At the end of each round (after all players have played two or three times) then add up all the energy points.
    f. Play another two or three rounds and the person with the most energy points win
2) Activity 2
    a. Pick out a few cards
    b. Discuss the habitats in which these animals live
    c. Talk about how, if any, humans are impacting those environments
    d. Discuss extreme situations such as the artic areas or desert environments
3) Closure
    a. Sum up habitats and food webs

Into the Forest Nature's Food Chain Game. (n.d). Retrieved June 29, 2003, from www.ampersandpress.com

# APPENDIX C

# SURVEY

| *Discovery Club Survey* | | | | | |
|---|---|---|---|---|---|
| **Please place a check mark in the box that is most likely true. This is not a test; I want to find out how well the Discovery Club went this year. Fill out as much as you can.** | | | | | |
| **After the Discovery Club was over…** | **Strongly Disagree**  | **Disagree**  | **Neutral**  | **Agree**  | **Strongly Agree**  |
| I think recycling is important | | | | | |
| I think saving water is important | | | | | |
| I think fish are neat | | | | | |
| I like bugs | | | | | |
| I think saving wildlife is important | | | | | |
| I like to recycle | | | | | |
| I think everyone should try to save water | | | | | |
| I like to look at different kinds of fish | | | | | |
| I think all bugs are bad | | | | | |
| I like to learn about where animals live | | | | | |
| I think recycling is fun | | | | | |
| I like saving water | | | | | |
| I like to learn about different kinds of fish | | | | | |
| I am scared of insects | | | | | |
| Helping injured animals is important | | | | | |

| **After the Discovery Club was over…** | **Strongly Disagree**  | **Disagree**  | **Neutral**  | **Agree**  | **Strongly Agree**  |
|---|---|---|---|---|---|
| I like to learn about the different kinds of mammals | | | | | |
| I think birds are neat | | | | | |
| I think amphibians and reptiles are neat | | | | | |
| I talk to my family about why recycling is important | | | | | |
| I try to use as little water everyday as I can | | | | | |
| I like to touch mammals even if I don't know them | | | | | |
| I like to watch birds | | | | | |
| I would like to have a turtle or a frog | | | | | |
| I pick up trash on the ground and throw it away | | | | | |
| I talk to my family about why it is not good to waste water | | | | | |
| I think mammals are cute | | | | | |
| I like to know the names of different kinds of birds | | | | | |
| I am scared of snakes | | | | | |
| I talk to my parents about reusing things before throwing them away | | | | | |
| When playing in the water, I try to waste as little as I can | | | | | |

| **After the Discovery Club was over…** | **Strongly Disagree**  | **Disagree**  | **Neutral**  | **Agree**  | **Strongly Agree**  |
|---|---|---|---|---|---|
| I would throw rocks at a fish | | | | | |
| I try not to harm good bugs | | | | | |
| I would try to help animals that are injured. | | | | | |
| I would touch a squirrel if it came up to me | | | | | |
| I would not handle a dead bird | | | | | |
| I try not to harm snakes or frogs | | | | | |
| I would like to have a fish as a pet | | | | | |
| If I catch a lizard, I would then let it go | | | | | |
| I do not approach wild animals | | | | | |
| I would try to help an injured mammal if I could | | | | | |
| I have talked to my parents about putting a birdfeeder in our yard | | | | | |
| I like to go looking for lizards, frogs or snakes | | | | | |
| I talked to my parents about the different shapes of fish | | | | | |
| I catch bugs in the house and let them go outside | | | | | |
| I talk to my parents about why wildlife is important | | | | | |
| I would not touch a wild mammal | | | | | |
| I listen to birds when they sing | | | | | |
| I only pick up snakes I know are not poisonous | | | | | |

| **After the Discovery Club was over…** | **Strongly Disagree**  | **Disagree**  | **Neutral**  | **Agree**  | **Strongly Agree**  |
|---|---|---|---|---|---|
| I would throw rocks at a fish | | | | | |
| I try not to harm good bugs | | | | | |
| I would try to help animals that are injured. | | | | | |
| I would touch a squirrel if it came up to me | | | | | |
| I would not handle a dead bird | | | | | |
| I try not to harm snakes or frogs | | | | | |
| I would like to have a fish as a pet | | | | | |
| If I catch a lizard, I would then let it go | | | | | |
| I do not approach wild animals | | | | | |
| I would try to help an injured mammal if I could | | | | | |
| I have talked to my parents about putting a birdfeeder in our yard | | | | | |
| I like to go looking for lizards, frogs or snakes | | | | | |
| I talked to my parents about the different shapes of fish | | | | | |
| I catch bugs in the house and let them go outside | | | | | |
| I talk to my parents about why wildlife is important | | | | | |
| I would not touch a wild mammal | | | | | |
| I listen to birds when they sing | | | | | |
| I only pick up snakes I know are not poisonous | | | | | |

| Before the Discovery Club… | **Strongly Disagree**  | **Disagree**  | **Neutral**  | **Agree**  | **Strongly Agree**  |
|---|---|---|---|---|---|
| I thought recycling was important | | | | | |
| I thought saving water was important | | | | | |
| I thought fish were neat | | | | | |
| I liked bugs | | | | | |
| I thought saving wildlife was important | | | | | |
| I liked to recycle | | | | | |
| I thought everyone should try to save water | | | | | |
| I liked to look at different kinds of fish | | | | | |
| I thought all bugs were bad | | | | | |
| I liked to learn about where animals live | | | | | |
| I thought recycling is fun | | | | | |
| I liked saving water | | | | | |
| I liked to learn about different kinds of fish | | | | | |
| I was scared of insects | | | | | |
| Helping injured animals was important | | | | | |

| Before the Discovery Club… | **Strongly Disagree**  | **Disagree**  | **Neutral**  | **Agree**  | **Strongly Agree**  |
|---|---|---|---|---|---|
| I liked to learn about the different kinds of mammals | | | | | |
| I thought birds were neat | | | | | |
| I thought amphibians and reptiles are neat | | | | | |
| I talked to my family about the importance of recycling. | | | | | |
| I tried to use as little water everyday as I could | | | | | |
| I liked to touch mammals even if I didn't know them | | | | | |
| I liked to watch birds | | | | | |
| I would have liked to have a turtle or a frog | | | | | |
| I picked up trash from the ground and threw it away | | | | | |
| I talked to my family about the importance of not wasting water | | | | | |
| I thought mammals were cute | | | | | |
| I liked to know the names of different kinds of birds | | | | | |
| I was scared of snakes | | | | | |
| I talked to my parents about reusing things before throwing them away | | | | | |
| When playing in the water, I try to use as little as I can | | | | | |

| Before the Discovery Club… | **Strongly Disagree**  | **Disagree**  | **Neutral**  | **Agree**  | **Strongly Agree**  |
|---|---|---|---|---|---|
| I would throw rocks at a fish | | | | | |
| I tried not to harm good bugs | | | | | |
| I would try to help animals that were injured. | | | | | |
| I would touch a squirrel if it came up to me | | | | | |
| I would not handle a dead bird | | | | | |
| I tried not to harm snakes or frogs | | | | | |
| I would have liked to have a fish as a pet | | | | | |
| If I caught a lizard, I would then let it go | | | | | |
| I did not approach wild animals | | | | | |
| I would try to help an injured mammal if I could | | | | | |
| I talked to my parents about putting a birdfeeder in our yard | | | | | |
| I liked to go looking for frogs or snakes | | | | | |
| I talked to my parents about the different shapes of fish | | | | | |
| I caught bugs in the house and let them go outside | | | | | |
| I talked to my parents about why wildlife is important | | | | | |
| I would not touch a wild mammal | | | | | |
| I listened to birds when they sang | | | | | |
| I only picked up snakes I knew were not poisonous | | | | | |

| ***Answer these questions as best you can.*** | | | | | |
|---|---|---|---|---|---|
| Where can you take items to recycle them? | Wal-Mart | Shoe Store | Trash Dump | | |
| What is one way you could save water? | Take a short shower | Take a long shower | Run water while doing dishes | | |
| Which fish lives at the bottom of the ocean? | Torpedo shaped | Flat bellied | Humpbacked | | |
| How many body parts do insects have? | 2 | 3 | 4 | | |
| What animal normally lives in very cold weather? | Polar Bear | Snake | Frog | | |
| What are some items in your house that you could reuse? | Milk Carton | Toothpaste | Dental Floss | | |
| What are the two kinds of water **(circle two)**? | Salt | Fresh | Chlorine | | |
| What is the life cycle of the salmon? | Egg, fry, alevin, adult | Egg, alevin, adult, fry | | | |
| Which bug is a good bug? | Ladybug | Mosquito | Fly | | |
| What animal normally lives in very hot weather? | Camel | Penguin | Bear | | |
| What are some items you could recycle? | Cans | Paper | Plastic | | |
| What is a way we waste water? | Leaving the sink running while brushing teeth | Using rain water to water your plants | Turning the hose off after I finish watering the garden | | |
| Which bug can jump and fly? | Bee | Dragonfly | Grass-hopper | | |
| What are four things an animal must have to live**(circle four)**? | Food | Water | Chocolate | Shelter | Space |

| Answer these questions as best you can. | | | | | |
|---|---|---|---|---|---|
| What animal group has the most number of species? | Mammals | Insects | Birds | Amphibians/ Reptiles | Fish |
| What animal group has the least number of species? | Mammals | Insects | Birds | Amphibians/ Reptiles | Fish |
| Which bird eats fish? | Cardinal | Pelican | Nighthawk | Nuthatch | |
| Which of the following are reptiles | Turtles | Frogs | Cows | Dogs | |
| Which mammal has a pouch for its baby? | Horse | Dog | Kangaroo | Deer | |
| Which bird doesn't fly? | Cardinal | Penguin | Duck | Hummingbird | |
| Which animal is closely related to the dinosaur? | Fish | Mammal | Reptile | | |
| What is the largest mammal? | Seal | Blue Whale | Horse | | |
| Which bird is more colorful? | Male | Female | | | |
| Which amphibian looks like a fish at the beginning of its life? | Snake | Alligators | Frogs | | |
| | **Strongly Disagree**  | **Disagree**  | **Neutral**  | **Agree**  | **Strongly Agree**  |
| I learned a lot from coming to Discovery Club | | | | | |
| I enjoyed participating in the Discovery club. | | | | | |
| If I could, I would participate in the Discovery Club again. | | | | | |
| I would tell a friend to participate in the Discovery Club. | | | | | |
| What was your most favorite part of the Discovery Club? | | | | | |
| What was your least favorite part of the Discovery Club? | | | | | |

# APPENDIX D

## KNOWLEDGE, ATTITUDE, AND BEHAVIOR INDIVIDUAL ITEM MEANS

*Individual Pre- and Post Test Means for Program*

| ***Pre-Program Retrospective Item*** | **Mean** | ***Post-Program Item*** | **Mean** | **N** |
|---|---|---|---|---|
| **Recycling** | | | | |
| I thought recycling was important | 3.84 | I think recycling is important | 4.53 | 19 |
| I liked to recycle | 3.37 | I like to recycle | 4.32 | 19 |
| I thought recycling is fun | 3.40 | I think recycling is fun | 3.80 | 20 |
| I talked to my family about the importance of recycling. | 3.00 | I talk to my family about why recycling is important | 3.05 | 20 |
| I picked up trash from the ground and threw it away | 4.15 | I pick up trash on the ground and throw it away | 4.15 | 20 |
| I talked to my parents about reusing things before throwing them away | 3.32 | I talk to my parents about reusing things before throwing them away | 3.38 | 19 |
| **Water** | | | | |
| I thought saving water was important | 3.65 | I think saving water is important | 4.55 | 20 |
| I thought everyone should try to save water | 3.63 | I think everyone should try to save water | 4.32 | 19 |
| I liked saving water | 3.35 | I like saving water | 3.94 | 17 |
| I tried to use as little water everyday as I could | 3.35 | I try to use as little water everyday as I can | 3.90 | 20 |
| I talked to my family about the importance of not wasting water | 2.85 | I talk to my family about why it is not good to waste water | 3.40 | 20 |
| When playing in the water, I try to use as little as I can | 2.89 | When playing in the water, I try to waste as little as I can | 3.37 | 19 |
| **Fish** | | | | |
| I thought fish were neat | 4.05 | I think fish are neat | 3.55 | 20 |
| I liked to look at different kinds of fish | 4.06 | I like to look at different kinds of fish | 4.24 | 17 |
| I liked to learn about different kinds of fish | 3.65 | I like to learn about different kinds of fish | 3.35 | 20 |
| I would throw rocks at a fish | 4.30 | I would throw rocks at a fish | 4.60 | 20 |
| I would have liked to have a fish as a pet | 4.05 | I would like to have a fish as a pet | 4.45 | 20 |
| I talked to my parents about the different shapes of fish | 2.50 | I talked to my parents about the different shapes of fish | 3.05 | 20 |
| **Insects** | | | | |
| I liked bugs | 2.95 | I like bugs | 2.90 | 20 |
| I thought all bugs were bad | 3.42 | I think all bugs are bad | 3.95 | 19 |
| I was scared of insects | 3.21 | I am scared of insects | 3.89 | 19 |
| I tried not to harm good bugs | 3.80 | I try not to harm good bugs | 4.35 | 20 |
| I caught bugs in the house and let them go outside | 3.20 | I catch bugs in the house and let them go outside | 3.60 | 20 |

*Individual Pre- and Post-Test Means for Program (continued)*

| **Wildlife/ Habitat** | Mean | | Mean | N |
|---|---|---|---|---|
| I thought saving wildlife was important | 4.40 | I think saving wildlife is important | 4.95 | 20 |
| I liked to learn about where animals live | 3.95 | I like to learn about where animals live | 4.40 | 20 |
| Helping injured animals was important | 3.90 | Helping injured animals is important | 4.70 | 20 |
| I would try to help animals that were injured. | 3.75 | I would try to help animals that are injured. | 4.35 | 20 |
| I did not approach wild animals | 3.39 | I do not approach wild animals | 3.72 | 18 |
| I talked to my parents about why wildlife is important | 3.16 | I talk to my parents about why wildlife is important | 3.47 | 19 |
| **Mammals** | | | | |
| I liked to learn about the different kinds of mammals | 3.90 | I like to learn about the different kinds of mammals | 4.55 | 20 |
| I liked to touch mammals even if I didn't know them | 2.94 | I like to touch mammals even if I don't know them | 2.71 | 17 |
| I thought mammals were cute | 3.75 | I think mammals are cute | 3.75 | 20 |
| I would touch a squirrel if it came up to me | 3.45 | I would touch a squirrel if it came up to me | 3.15 | 20 |
| I would try to help an injured mammal if I could | 3.72 | I would try to help an injured mammal if I could | 4.33 | 18 |
| I would not touch a wild mammal | 3.21 | I would not touch a wild mammal | 3.21 | 19 |
| **Amphibians/ Reptiles** | | | | |
| I thought amphibians and reptiles are neat | 3.88 | I think amphibians and reptiles are neat | 4.29 | 17 |
| I would have liked to have a turtle or a frog | 3.50 | I would like to have a turtle or a frog | 3.20 | 20 |
| I was scared of snakes | 3.47 | I am scared of snakes | 3.63 | 19 |
| I tried not to harm snakes or frogs | 3.63 | I try not to harm snakes or frogs | 3.89 | 19 |
| If I caught a lizard, I would then let it go | 3.50 | If I catch a lizard, I would then let it go | 4.00 | 18 |
| I liked to go looking for frogs or snakes | 3.85 | I like to go looking for lizards, frogs or snakes | 3.65 | 20 |
| I only picked up snakes I knew were not poisonous | 2.95 | I only pick up snakes I know are not poisonous | 3.10 | 20 |

*Individual Pre- and Post-Test Means for Program (continued)*

| **Birds** | | | | |
|---|---|---|---|---|
| I thought birds were neat | 4.05 | I think birds are neat | 4.47 | 19 |
| I liked to watch birds | 4.05 | I like to watch birds | 3.74 | 19 |
| I liked to know the names of different kinds of birds | 3.40 | I like to know the names of different kinds of birds | 4.35 | 20 |
| I would not handle a dead bird | 2.65 | I would not handle a dead bird | 2.95 | 20 |
| I talked to my parents about putting a birdfeeder in our yard | 3.20 | I have talked to my parents about putting a birdfeeder in our yard | 3.90 | 20 |
| I listened to birds when they sang | 3.40 | I listen to birds when they sing | 4.10 | 20 |

*Chi-Square Test of Knowledge Questions*

| | **Program Wrong** | **Program Right** | **Control Wrong** | **Control Right** | **Chi Square** | ***df*** | ***Sig.*** |
|---|---|---|---|---|---|---|---|
| Where can you take items to recycle them? | 63.2 | 36.8 | 54.2 | 45.8 | 0.35 | 1 | 0.39 |
| What is one way you could save water? | 0.0 | 100.0 | 3.8 | 96.2 | 0.79 | 1 | 0.57 |
| Which fish lives at the bottom of the ocean? | 35.0 | 65.0 | 21.4 | 78.6 | 1.09 | 1 | 0.24 |
| How many body parts do insects have? | 5.3 | 94.7 | 17.9 | 82.1 | 1.61 | 1 | 0.21 |
| What animal normally lives in very cold weather? | 5.0 | 95.0 | 0.0 | 100.0 | 1.33 | 1 | 0.44 |
| What are some items in your house that you could reuse? | 5.3 | 94.7 | 21.4 | 78.6 | 2.33 | 1 | 0.13 |
| What are the two kinds of water (circle two)? | 30.0 | 70.0 | 29.6 | 70.4 | 0.00 | 1 | 0.61 |
| What is the life cycle of the salmon?* | 15.0 | 85.0 | 60.7 | 39.3 | 10.03 | 1 | 0.00 |
| Which bug is a good bug? | 5.0 | 95.0 | 11.1 | 88.9 | 0.55 | 1 | 0.43 |
| What animal normally lives in very hot weather? | 5.0 | 95.0 | 0.0 | 100.0 | 1.43 | 1 | 0.42 |
| What are some items you could recycle?* | 68.4 | 31.6 | 33.3 | 66.7 | 5.50 | 1 | 0.02 |
| What is a way we waste water? | 5.0 | 95.0 | 10.7 | 89.3 | 0.50 | 0 | 0.37 |
| Which bug can jump and fly? | 5.0 | 95.0 | 3.7 | 96.3 | 0.05 | 1 | 0.68 |
| What are four things an animal must have to live (circle four)? | 10.0 | 90.0 | 7.4 | 92.6 | 0.10 | 1 | 0.57 |
| What animal group has the most number of species?* | 36.8 | 63.2 | 73.1 | 26.9 | 5.91 | 1 | 0.02 |
| What animal group has the least number of species? | 50.0 | 50.0 | 81.5 | 18.5 | 5.24 | 1 | 0.02 |
| Which bird eats fish? | 5.0 | 95.0 | 7.7 | 92.3 | 0.13 | 1 | 0.60 |
| Which of the following are reptiles? | 27.8 | 72.2 | 37.5 | 62.5 | 0.44 | 1 | 0.37 |
| Which mammal has a pouch for its baby? | 15.0 | 85.0 | 0.0 | 100.0 | 4.02 | 1 | 0.08 |
| Which bird doesn't fly? | 5.0 | 95.0 | 19.2 | 80.8 | 2.02 | 1 | 0.17 |
| Which animal is closely related to the dinosaur? | 10.0 | 90.0 | 3.8 | 96.2 | 0.70 | 1 | 0.40 |
| What is the largest mammal? | 0.0 | 100.0 | 7.4 | 92.6 | 1.55 | 1 | 0.33 |
| Which bird is more colorful? | 20.0 | 80.0 | 30.8 | 69.2 | 0.68 | 1 | 0.32 |
| Which amphibian looks like a fish at the beginning of its life? | 20.0 | 80.0 | 7.4 | 92.6 | 1.64 | 1 | 0.20 |

Note: * Scales significant, $p<0.05$.

*Means of Individual Items for Program and Control Groups*

| Individual Items | Program | Control | PN | CN |
|---|---|---|---|---|
| I think recycling is important | 4.5 | 4.2 | 19 | 29 |
| I think saving water is important | 4.6 | 4.4 | 20 | 29 |
| I think fish are neat | 3.6 | 3.4 | 20 | 29 |
| I like bugs | 2.9 | 3.6 | 20 | 30 |
| I think saving wildlife is important | 5.0 | 4.6 | 20 | 29 |
| I like to recycle | 4.3 | 3.9 | 19 | 30 |
| I think everyone should try to save water | 4.4 | 4.2 | 20 | 29 |
| I like to look at different kinds of fish | 4.2 | 3.8 | 17 | 28 |
| I think all bugs are bad | 4.0 | 4.3 | 20 | 28 |
| I like to learn about where animals live | 4.4 | 4.2 | 20 | 28 |
| I think recycling is fun | 3.8 | 3.6 | 20 | 29 |
| I like saving water | 3.9 | 3.9 | 17 | 29 |
| I like to learn about different kinds of fish | 3.4 | 3.8 | 20 | 28 |
| I am scared of insects | 3.9 | 4.3 | 19 | 28 |
| Helping injured animals is important | 4.7 | 4.7 | 20 | 30 |
| I like to learn about the different kinds of mammals | 4.6 | 4.3 | 20 | 27 |
| I think birds are neat | 4.5 | 4.1 | 20 | 29 |
| I think amphibians and reptiles are neat | 4.3 | 4.2 | 18 | 29 |
| I talk to my family about why recycling is important | 3.1 | 2.7 | 20 | 28 |
| I try to use as little water everyday as I can | 3.9 | 3.4 | 20 | 28 |
| I like to touch mammals even if I don't know them | 2.7 | 3.3 | 18 | 28 |
| I like to watch birds | 3.7 | 4.1 | 19 | 27 |
| I would like to have a turtle or a frog | 3.2 | 4.2 | 20 | 29 |
| I pick up trash on the ground and throw it away | 4.2 | 3.8 | 20 | 27 |
| I talk to my family about why it is not good to waste water | 3.4 | 2.9 | 20 | 28 |
| I think mammals are cute | 3.8 | 4.2 | 20 | 28 |
| I like to know the names of different kinds of birds | 4.4 | 4.1 | 20 | 27 |
| I am scared of snakes | 3.6 | 4.0 | 19 | 28 |
| I talk to my parents about reusing things before throwing them away | 3.2 | 3.3 | 20 | 29 |
| When playing in the water, I try to waste as little as I can | 3.4 | 3.4 | 20 | 29 |
| I would throw rocks at a fish | 4.6 | 4.3 | 20 | 28 |
| I try not to harm good bugs | 4.4 | 3.8 | 20 | 28 |
| I would try to help animals that are injured. | 4.4 | 4.1 | 20 | 29 |
| I would touch a squirrel if it came up to me | 3.2 | 3.3 | 20 | 28 |
| I would not handle a dead bird | 3.0 | 2.9 | 20 | 29 |
| I try not to harm snakes or frogs | 3.8 | 4.1 | 20 | 28 |
| I would like to have a fish as a pet | 4.5 | 3.9 | 20 | 27 |
| If I catch a lizard, I would then let it go | 4.0 | 3.8 | 18 | 28 |
| I do not approach wild animals | 3.8 | 4.0 | 19 | 28 |
| I would try to help an injured mammal if I could | 4.3 | 4.5 | 19 | 29 |

*Means of Individual Items for Program and Control Groups (continued)*

| Individual Items | Program | Control | PN | CN |
|---|---|---|---|---|
| I have talked to my parents about putting a birdfeeder in our yard | 3.9 | 3.1 | 20 | 29 |
| I like to go looking for lizards, frogs or snakes | 3.7 | 3.7 | 20 | 28 |
| I talked to my parents about the different shapes of fish | 3.1 | 2.8 | 20 | 28 |
| I catch bugs in the house and let them go outside | 3.6 | 3.6 | 20 | 28 |
| I talk to my parents about why wildlife is important | 3.5 | 3.4 | 19 | 28 |
| I would not touch a wild mammal | 3.2 | 3.4 | 19 | 28 |
| I listen to birds when they sing | 4.2 | 3.4 | 20 | 28 |
| I only pick up snakes I know are not poisonous | 3.1 | 3.2 | 20 | 28 |

# VITA

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## EDUCATION

Bachelor of Science May 2002
Texas A&M University, College Station, Texas
Wildlife & Fisheries Sciences; Minor: Psychology

Master of Science, May 2004
Texas A&M University, College Station, Texas
Recreation, Park & Tourism Sciences

## PROFESSIONAL EXPERIENCE

Program Director, Discovery Club environmental education program
Kid's Klub, College Station, Texas; May 2004- present

Research Assistant, Evaluation of Youth After School Programs
Texas A&M University, College Station, Texas; January 2004- present

Teaching Assistant, Recreation, Parks, and Diverse Populations
Texas A&M University, College Station, Texas; September 2002-December 2003

Environmental Education Intern, Student Conservation Agency
Kenai Fjords National Park, Seward, Alaska; April 2003-July 2003

Volunteer Curator, Fleay's Wildlife Park
Burleigh Heads, Australia; January 2000- April 2000

## ACADEMIC INFORMATION

### Conference Attendance

1. National Recreation and Park Administration annual meeting and Research Symposium.

Member: Graduate Teaching Academy, National Recreation and Park Association, National Association of Interpretation, Alpha Zeta Alumni

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### Scholastic Honors

2001: Houston Rodeo Scholarship Recipient
Outstanding Pledge Alpha Zeta National Honor Society
2000: Outstanding work conducted outside the classroom
1998: Student Council Scholarship Recipient